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A PILOT PROJECT FOR THE DEVELOPMENT OF EDUCATIONAL RESEARCH TECHNIQUES AND PROCEDURES SUITABLE FOR THE MEASUREMENT OF INSTITUTIONAL STABILITY AND CHANGE.

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THE PROBLEM INVESTIGATED IN THIS STUDY INVOLVED THE DEVELOPMENT OF TECHNIQUES AND PROCEDURES THAT COULD YIELD MEASURES OF INSTITUTIONAL STABILITY AND CHANGE ALONG A TIME CONTINUUM. THE STUDY FOCUSED ON THE PUPILS AND TEACHERS IN THE UNIVERSITY SCHOOL OF KENT STATE UNIVERSITY (658 PUPILS IN KINDERGARTEN CLASSES THROUGH GRADE 12 AND 29 INSTRUCTORS). IN THE FIRST PART OF THE STUDY, DATA PROCESSING METHODS WERE DEVELOPED FOR CODING AND STORING DATA ON THE PUPILS. TWO BASIC CARD DESIGNS, EMPLOYING COLOR CODING, WERE DEVELOPED. A COMPUTER PROGRAM WAS DEVELOPED TO COMPUTE THE MEAN, STANDARD DEVIATION, AND HIGH AND LOW SCORES ON A SERIES OF TESTS GIVEN AT DIFFERENT TIMES. THE STUDY ALSO USED A STANDARD INTERCORRELATION MATRIX PROGRAM THAT WOULD PROCESS UP TO 50 VARIABLES. ELEVEN INSTRUMENTS WERE EMPLOYED IN GATHERING PUPIL DATA. DATA ON INSTRUCTORS WERE OBTAINED FROM THEIR SCORES ON THE MINNESOTA TESTS OF CREATIVE THINKING, THE ROKEACH DOGMATISM SCALE, AND THE TAYLOR MANIFEST ANXIETY SCALE. THE TEST DATA WERE TREATED IN A NUMBER OF WAYS AND EXAMINED FOR POSSIBLE RELATIONSHIP TO INSTITUTIONAL ASPECTS OF CHANGE OR STABILITY. THE SYSTEM DEVELOPED WAS JUDGED SUCCESSFUL ENOUGH TO WARRANT ITS CONTINUED USE. (JC)

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A PILOT PROJECT FOR THE DEVELOPMENT OF EDUCATIONAL RESEARCH TECHNIQUES AND PROCEDURES SUITABLE FOR THE MEASUREMENT OF INSTITUTIONAL STABILITY AND CHANGE

Cooperative Research Project No. S-156
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Principal Investigator

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D.T.

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CHAPTER I

INTRODUCTION

Problem

The problem investigated in this study involved the development of techniques and procedures that could yield measures of institutional stability and change along a time continuum.

Parametric data on the relative stability and change of developmental variables is exceedingly scarce. Bloom (1964) in his recent publication, _Stability and Change in Human Characteristics_, listed eight longitudinal studies that dealt with the problem with sufficient precision to be useful in his re-analysis.

Relatively little is known about the degree of steady-state functioning of any institution; although studies of hospitals and industrial plants, Argyris (1956 and 1960) suggest that most institutions reach a state of equilibrium in which institutional forces are in a state of dynamic balance that is highly resistant to change. An even more provocative description of the effects of very stable institutional forces is contained in the study of mental institutions by Goffman (1961). Perhaps the major reason why institutional change is so difficult to effect may lie in our lack of understanding of the factors that must be controlled in order for constructive change to develop.

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Almost all schools in the United States collect data on the academic progress of their pupils; yet in most cases this information is used either for classification of pupils or for individual diagnostic purposes, if indeed it is used at all. Although such data accumulates in files, little attempt has been made to use even this meager source of information to assess the general affect of the operation of the educational processes on the student body over a period of time. In the past few years school administrators have become increasingly interested in the possible application of electronic data processing techniques to the solution of administrative problems, yet few attempts have been made to adapt this powerful technique to the analysis of the effects of the instructional program. Whitlock (1965) in his book, Automatic Data Processing in Education, devotes six out of 138 pages to a brief look at possibilities in this area while the bulk of his writing is addressed to the uses of this technique with respect to grading, inventory records, payrolls, scheduling and other aspects of personnel accounting and school business management. The central educational problems facing educators have, as yet, not been seen by individual school administrators as approachable through these techniques.

On a national level, the Project Talent study developed by John Flannigan has been organized to yield parametric, longitudinal data on a large and carefully selected sample of school pupils. These data have not, as yet, been related to specific institutions--indeed they probably cannot be related in this way because of the necessity to conceal the identity of specific institutions.

A project of national scope now under development does propose to deal with institutional differences and Gardner (1965) has said of this project for the national assessment of educational progress that, "..... assessment results, especially coupled with auxiliary information on characteristics of various regions, communities, schools etc., would provide data necessary for research on educational problems and processes which cannot be undertaken now."

The problem addressed in this small study does appear to have considerable importance. If the processes developed and used in this pilot effort can be employed easily by local school leaders for the analysis of their specific educational problems, the work may make an important contribution to the eventual understanding of some of the potent forces we deal with daily, yet do not fully comprehend.

Objectives

The objectives of this study were as follows:

1. To devise simple and relatively efficient ways of coding and storing the kinds of data usually collected by schools that would lend themselves to the study of the cumulative effects of the educational environment on the pupils who pass through it.

2. To analyze in a number of different ways the data collected and organized in the school system under study in hopes that some indications of the relative stability of the educational environment can be found and that the affect of gross environmental change can be noted.
3. To examine the usefulness of a number of measurement instruments to see which of them might be most sensitive to gross institutional change and which, therefore, might be most useful as indices of changes taking place in the educational setting.

Related Research

The problem of assessing the total functioning of an organization is one that is just beginning to attract the attention of researchers in general and educational researchers in particular. Although industrial concerns have for the past twenty years been steadily developing ways of estimating the effectiveness of an organization developed for the production of some kind of product, it is only in recent years that leaders of other kinds of organizations have begun to develop similar concerns about the complex social systems they administer. Perhaps the best contemporary statement of the problem can be found in a small publication entitled Organizational Measurement by Barton (1961). In this publication Barton points out that the substantive classification of what can be measured in an organization includes measures of input, measures of output and measures of environment. In the present study the concern has been focused mainly on measurements of input and output.

A further problem involved in the assessment of organizational effectiveness lies in the fact that many of the variables which may affect the behavior of individuals belonging to the organization produce their effects slowly and over a considerable period of time. Since the bulk of educational research up to this time has been focused on short term studies, it seems likely that many of the changes we might wish to measure can only be detected by means of well designed longitudinal studies. Campbell and Stanley have devoted considerable attention to this problem in their chapter in the Handbook of Research on Teaching entitled Experimental and Quasi--Experimental Designs (1963).

Bloom's recent publication, Stability and Change in Human Characteristics (1964), has again called attention to the lack of longitudinal studies in this area and his ingenious use of the Overlap Hypothesis as stated by Kelly (1924) and by Anderson (1939), has illustrated a powerful technique for the sutdy of data collected over long time spans.

Longitudinal studies of growth and development have a long and important history in research literature; however, many of the most useful investigations, Piaget (1960) and Gesell (1925-1946) for example, have employed case-study designs. Studies employing successive and comparable measures over a time continuum are rare. One major exception is Terman's Genetic Study of Genius (1947) but in this instance institutional referents were not included. Perhaps the best contemporary example of such an approach is contained in a study of motor performance and growth by Jones, (1949). This study included as subjects 139 boys and girls, and was carried out over a span of seven years. Four aspects of static dynamometric strength were studied and the analysis of data resulted in a series of curves reflecting the operation of both maturation and environmental factors. The feasibility of collecting data over a span of years and analyzing it in terms of characteristic growth patterns seems well established by this study.

Studies originating with the Yale Labor and Management Center conducted by Chris Arygris, (1956-1960) all suggest that steady-state operation is a phenonema observable in industry, hospitals, and similar institutions. In theoretical discussions of the problems of organizational research Argyris points out that, "Change in an organization may not therefore be understood unless the 'steady-state' of the organization is first understood".

Additional evidence for suspecting that institutions do operate in a steady-state fashion is contained in college entrance studies, for example, those by Bloom and Peters, (1961). It seems to be well established that some secondary schools consistantly graduate high calibre students year after year while other schools exhibit equally reliable performance in terms of graduates who are much less well equipped. The investigation proposed herein should make it possible to define the extent of such stable functioning and to uncover the specific dimensions along which such consistent effects are transmitted.

In terms of research design and techniques, two major sources should be cited. Sidman, (1960) has explored in great detail the possible applications of steady-state baseline techniques to psychological experimentation using a single species as subject. Although there are great dangers involved in adapting this model for use in experimentation which takes the total institution as its unit, many features of this approach appear to be applicable. A second source is in the work previously cited by Campbell and Stanley, (1963). Of particular relevance is their comment on the strengths and limitations of their time-series design.

> The prevalence of this design in the more successful sciences should give us some respect for it, yet we should remember that the facts of "experimental isolation" and "constant conditions" make it more interpretable for them than for us. It should also be remembered that, in their use of it, a single experiment is never conclusive. While a control group may never be used, Design 7 is repeated in many different places by various researchers before a principle is established. This, too, should be our use of it. Where nothing better controlled is possible, we will use it. We will organize our institutional bookkeeping to provide as many time series as possible for such evaluations and will try to examine in more detail than we have previously the effects of administrative changes and other abrupt and arbitrary events as X's. But these will not be regarded as definitive until frequently replicated in various settings.

A number of the instruments used in the present study are relatively new and no reliable norms for the general population of school children are available. Consequently, a few studies employing instruments of this type are well worth citing.

Flescher (1963), using the Sarason General Anxiety Scale for Children and the Test Anxiety Scale for Children found that differences in achievement in the pupils he studied were not related to anxiety as measured by these instruments although analysis of variance of his data indicated a slight relationship among these variables. Intercorrelations between total achievement and total anxiety were approximately -.19. Correlation in this study between total achievement and total creativity as measured by selected parts of the Guilford battery were .09. Edwards, Meridith and Tyler (1965), using two scales from the Minnesota Creativity Tests found that pupils who were high scorers on both achievement and creativity were significantly low on grade point average. Feldhusen, Denny and Condon (1965), found no relationship between anxiety as measured by the General Anxiety Scale for Children and creativity.

The Dogmatism Scale developed by Rokeach (1960), has not generally been used with subjects below the college age; however, Kemp and Kohler (1965) have tested the suitability of this scale for use with secondary school pupils and found it satisfactory. They report a mean score of 165.75 for 350 eighth and ninth grade pupils and found a standard deviation of 31.86 and a range of 101 to 239. Rippy (1965), in a study of 280 pupils enrolled in church schools in North Carolina found significant differences among groups in the sample when stratified by size of church and among churches without regard to size. Mean scores for groups of subjects varied by strata from 140.55 to 178.79

In general, the studies reviewed in this section support the feasability of the research proposed and give some direction to the work undertaken.

CHAPTER II

PROCEDURE

The study reported herein was focused on the pupils and teachers in the University School of Kent State University. The total pupil population of the school in the academic year 1964-65 numbered 658 in classes including kindergarten through grade twelve. The organization for instruction included one section each of grades one through eight with average enrollments of twenty-eight pupils. The population of classes nine through twelve ranged from eighty-eight for grade nine to one-hundred for grade twelve. The faculty for the same year included thirty-eight full-time and eleven part-time instructors.

Data Processing Design

The first part of the study involved the development of a systematic way of coding and storing the data already in school files and additional information to be collected. The system evolved included two basic card designs. For each pupil an identification card was prepared which reserved space on a standard eighty column IBM card as follows: columns seventy-five through eighty were reserved for an IBM code number assigned to each pupil in the school, six digits being sufficient for numbering this size population. Columns

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fifty-one through seventy-four were reserved for alphabetic coding of first and last name of the pupil. Columns forty-nine and fifty were reserved for the indication of the number of the card belonging to the particular student identified. Columns forty-seven and forty-eight were reserved for the last two digits of the year in which these data were recorded. Columns forty-five and forty-six were reserved for the last two digits of the year the individual entered the University School. Columns forty-three and forty-four carried the last two digits of the year in which the individual was expected to graduate, and column forty-two carried a code indication of the sex of the pupil. Column forty-one carried an 0-2-8 punch which was a code that indicated to the data processing equipment that all information to the left of the code was to be processed as variables.

Additional cards for each pupil carried in columns fifty-six through eighty the student code number, last name, the card number of this particular set of student cards, and the sex of the student. On these subsequent cards the 0-2-8 code punch was entered in column fifty-five.

On all cards fields of four digits were marked off to contain the scores for data on the variables under study. A blank column was left between each data field.

In general, a separate card was used to record data for test batteries that yielded a series of part scores. The Iowa Test of Basic Skills was recorded on a separate card each time the test was administered to a specific pupil. Tests yielding a single variable were recorded on space available on the basic identification card or on other cards as needed. The IBM Card Layout Form, X74-7049-12 was used to specify the columns assigned to carry the information to be used.

Color coding was employed to simplify the handling of cards once data were punched on them. For example, all basic identification cards were uncolored natural stock; all California Achievement Test data cards were pink, and all Iowa Test of Educational Development data cards were natural stock with a purple stripe.

It should be pointed out that the data used in this study were processed on an IBM 1620 computer. The standard programs in use with this device at the Kent State computer center were designed to read data from four digit fields with a blank column between fields. Data punched into the fields were right hand justified so that the last digit in the datum occupied the extreme right-hand column in the field. Thus standard programs could be used without change in card design.

Figure 1

IBM Card Design: Basic Identification Plus Five Variables

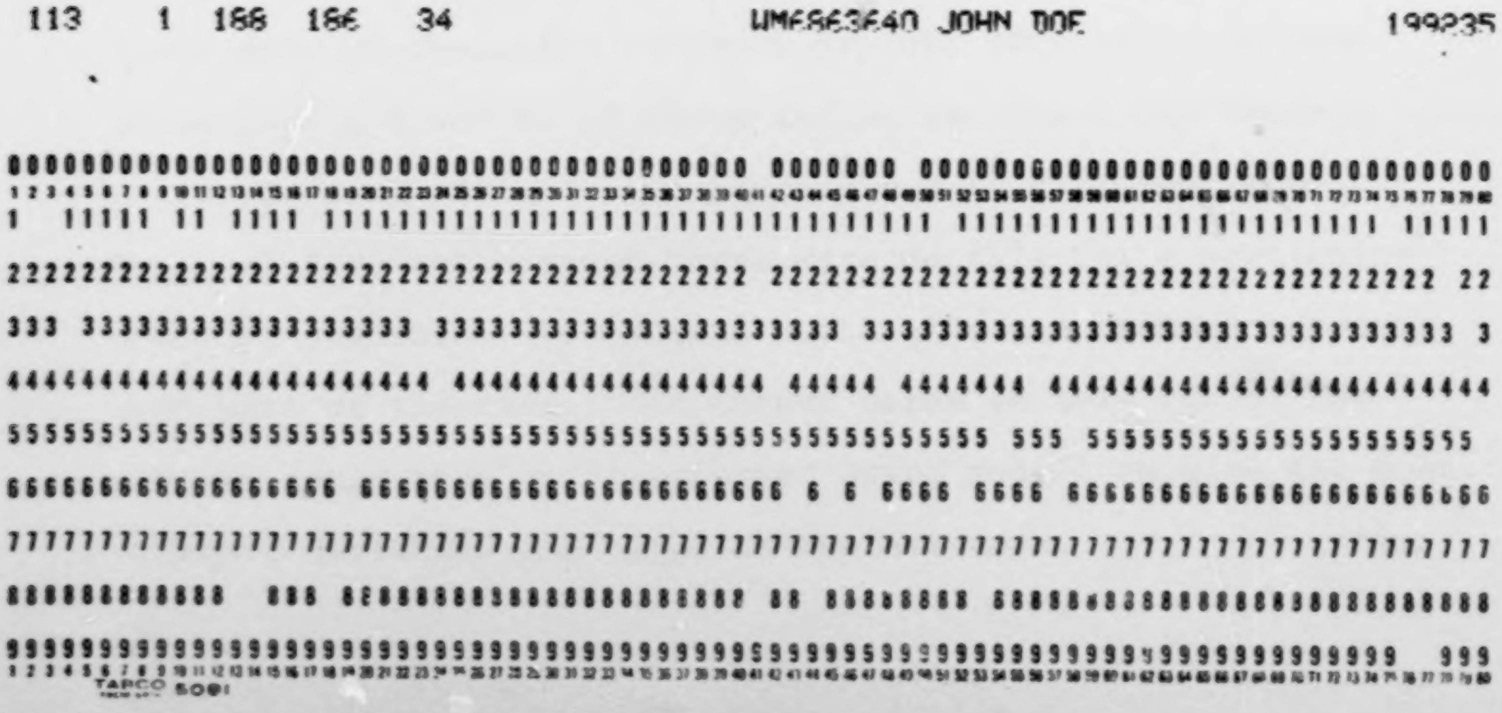
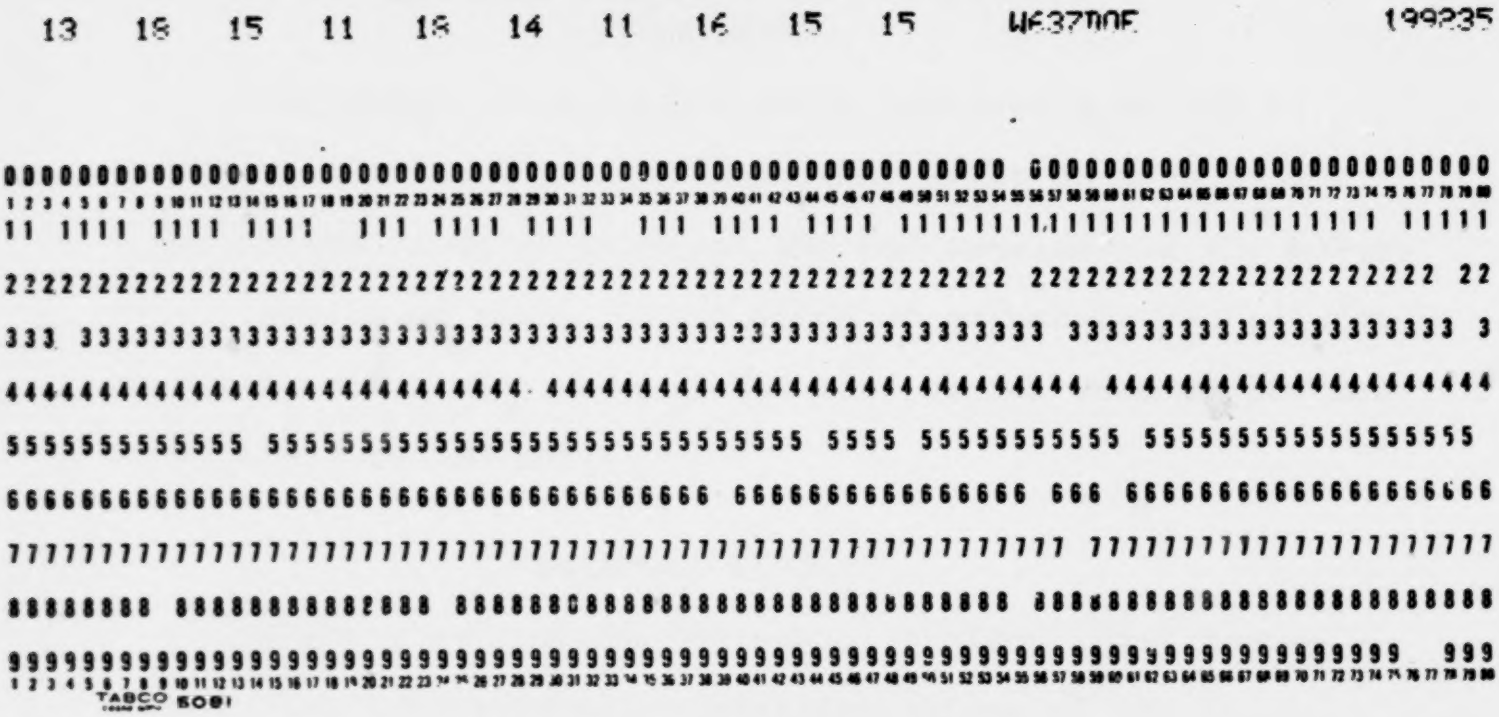


Figure 2

IBM Card Design: Basic Identification Plus Ten Variables from Iowa Test of Educational Development



Computer Programs

Two programs were used for processing data. The first of these was designed for the study by Mr. Daniel Lott at the computer center. This program which is included in Appendix A was designed to yield mean, standard deviation and high and low scores in the range and could be used in two ways. In the first mode of operation it would process each variable independently on a series of tests giving as output the average score for each variable for tests given at different times. Thus, if five achievement tests were on file for a particular group of students, the program would give the average score on each part of the test. The output cards on this run of the program could then be reprocessed using mode 1 to give the mean, standard deviation and range of the averages.

The second program used was a standard intercorrelation matrix program that would process up to fifty variables.

Record Search

Preliminary work on the study involved a search of existing school records for data that might be used in a longitudinal study of students who had remained in the school over a period of time. Entry dates on permanent records for pupils by class were checked and test scores were copied and transferred to IBM cards.

Variables Studied

Existing records in the school yielded intelligence test scores from successive administrations of the Lorge-Thorndike test. For some classes both verbal and non-verbal scores were available and for all classes verbal scores were on record. In all cases the score from the latest testing period was used.

Complete scores from administrations of the California Achievement Tests given in 1954, 55, 56, 57 and 58 were available and were used in the study.

Scores on the Iowa Test of Basic Skills were available for the years 1961, 62, 63 and 64 and were used in the study.

The Iowa Test of Basic Skills administered to grades nine and eleven in 1963 and to grades nine, ten and eleven in 1964 were available and were used.

Socio-economic rank was calculated on the basis of fathers' occupation using the Department of Commerce

Occupational listing, Table G6, with occupations listed classified into eleven categories.

Grade point average was calculated for students in grades nine through twelve. The average used for each class was a cumulative average. (No grades are given to elementary school pupils in the school).

The *Minnesota Tests of Creative Thinking*, Form K-U-B were administered to grades nine and eleven in 1963 and 1964. Total scores from this battery were employed in the study.

The *Rokeach Dogmatism Scale*, Form E, Rokeach (1960), was administered to ninth and eleventh grades in 1964 and 1965. Total scores from this scale were used in the study.

The *Taylor Manifest Anxiety Scale* was also given to ninth and eleventh grade pupils in 1964 and 1965 and the scores obtained were utilized in the study.

The *Michigan State M Scales*, Form C, Male and Female versions, Fahrquar (1964), were given to ninth and eleventh grade pupils in 1965 and the results utilized in the study.

Two experimental motivation scales, *The Junior Index of Motivation* and *The Ohio State Picture Preference Scale*, Frymier (1965), were also employed in the study and were administered to ninth and eleventh grade pupils in 1965.

Faculty members of the school completed the *Minnesota Tests of Creative Thinking*, the *Rokeach Dogmatism Scale* and the *Taylor Manifest Anxiety Scale* in the spring of 1964 and these data were used in the study.

Only two institutional variables were employed in the present study--changes in teaching staff and changes in administration.

Analysis of Data

The data collected during the course of the study were treated in the following ways:

1. Achievement test data for intact groups of pupils were plotted graphically and examined for possible relationship with institutional change and interpreted in terms of the relative stability of educational growth within the school.
2. The scores of individual pupils included in the longitudinal study described in 1. above whose scores fell one standard deviation above or below the longitudinal mean were plotted graphically and the relationship of these growth curves to the data for the total group in 1. above were studied.
3. Achievement test data for a series of classes were plotted graphically at a specific point in time and these graphs were examined for possible relationships to institutional aspects of change or stability.
4. Variables employed in the study were organized into tables of means and standard deviations by class and by sex and examined for possible interrelationships among the variables.
5. Dichotomized pupil groups were established in terms of their score on a particular variable falling

above or below one standard deviation above the mean and the differences between these groups in terms of other variables were tested using the Chi-square statistic.

6. Mean scores and standard deviations of data gathered on faculty members were compared with corresponding information available for students.

CHAPTER III

ANALYSIS OF DATA AND FINDINGS

Longitudinal Data

A record search of data available in school files revealed the fact that nine groups of students had remained in the school continuously since grade one and for these groups sufficient data were available to make possible the generation of growth curves for varying lengths of time. Table I, below, shows the composition of these groups.

Table I

Intact Groups of Students by Grade, Number in the Group and Number of Separate Achievement Tests Available.

Grade	Year Graduating	Number of Pupils	Number of Tests
12	1965	11	3
11	1966	12	3
10	1967	9	3
9	1968	14	3
8	1969	24	3
7	1970	19	5
6	1971	20	3
5	1972	20	3
4	1973	26	2

Since beginning class size at the University School is approximately twenty-eight, the data indicates that roughly

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one-third of the pupils who begin work at the school complete grade twelve.

As a first step in the analysis, the means of the part scores and composite scores were plotted on the same scale for grade four through nine and again for grades eleven through twelve. The Iowa Test of Basic Skills yielded the data charted for grades four through nine while the information shown for grades ten through twelve resulted from administration of the California Achievement Test. Charts obtained from Iowa Test data are displayed on the following pages and are labeled Figures 3 through 8.

Longitudinal Data Derived From the Iowa Test of Basic Skills.

An inspection of the charted growth lines in Figure 3, for the composite means on the Iowa Test of Basic Skills reveals a remarkable evenness of growth in terms of the scores plotted. Line slopes computed in terms of months of growth divided by chronological time elapsed reveal the greatest difference between grade four with a slope of .059 and grade six with a slope of .100. The slope of the scores for grade nine is approximately the same as that for grade four, calculations yielding a slope of .061. The means and standard deviations of I.Q. for these three groups of pupils is as follows:

Grade	I.Q.	Standard Deviation
Four	110.7	22.0
Six	114.7	13.8
Nine	113.7	13.4

Figure 3

Growth Charts Based on Mean Composite Scores on the Iowa Test of Basic Skills, Grades Four Through Nine

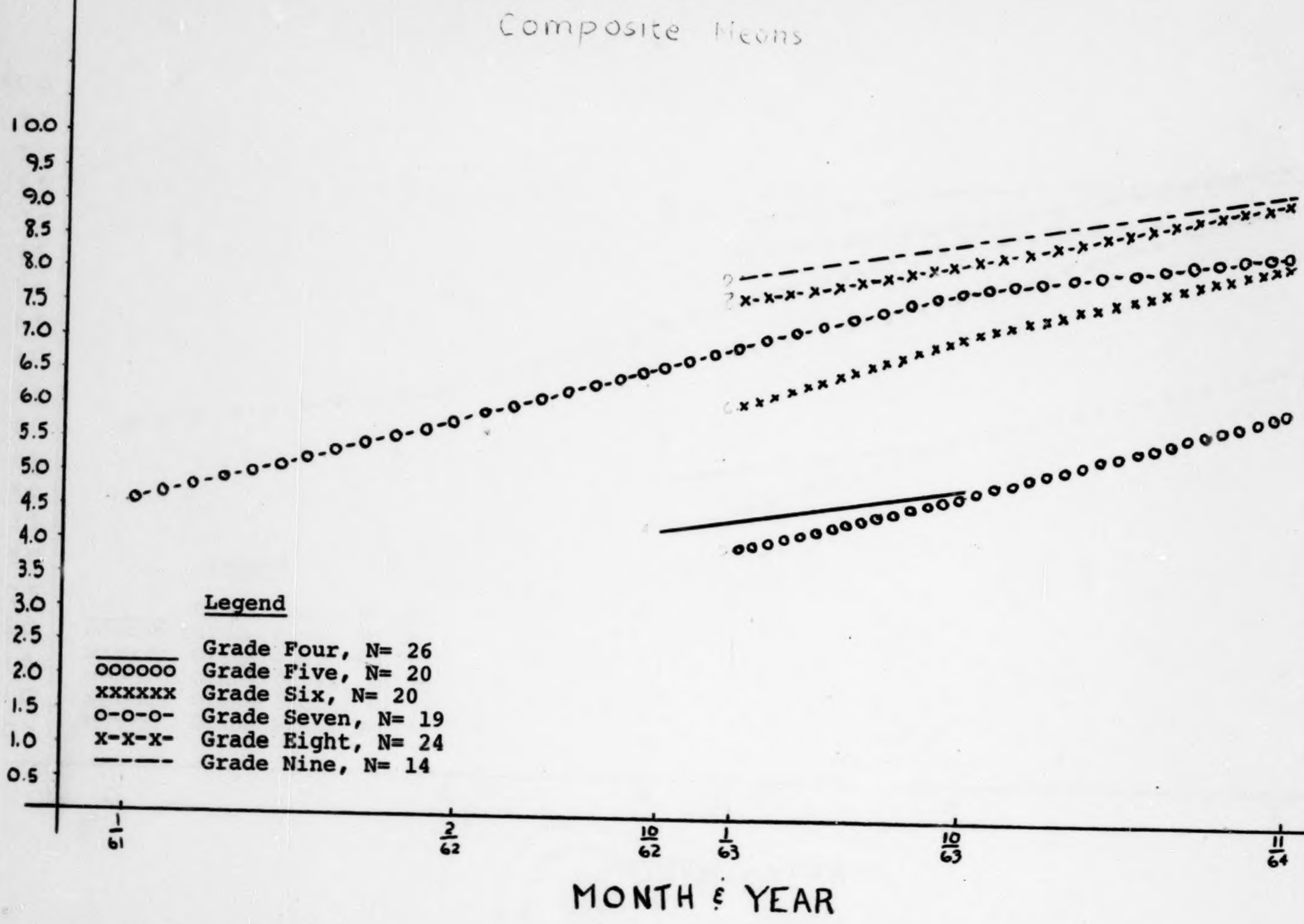
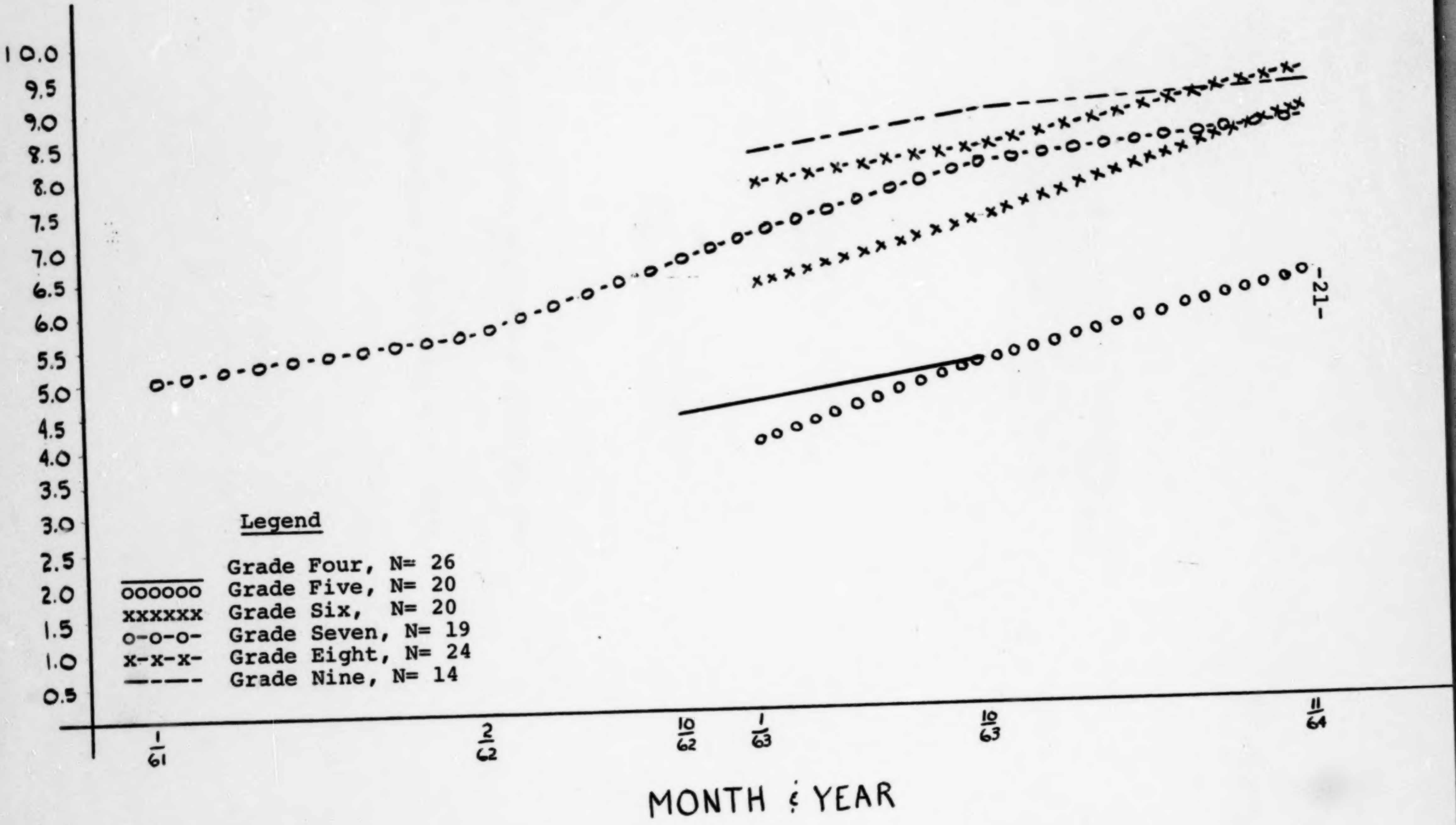


Figure 4

Growth Charts Based on Mean Scores for Vocabulary on the Iowa Test of Basic Skills, Grades Four Through Nine



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A PILOT PROJECT FOR THE DEVELOPMENT OF EDUCATIONAL RESEARCH TECHNIQUES AND PROCEDURES SUITABLE FOR THE MEASUREMENT OF INSTITUTIONAL STABILITY AND CHANGE

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Cooperative Research Project No. S-156

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SUMMARY

BACKGROUND

Because little is known about the stability or steady-state functioning of institutions or organizations in general and probably less about this phenomenon with respect to educational organizations, it seemed useful to explore ways in which the stable functioning of an educational institution could be charted.

In addition it seemed useful to explore the possible applications of data processing techniques to this problem and to explore the feasibility of using a number of measures of variability to chart the stability expected to be found.

OBJECTIVES

The objectives of the study were as follows:

1. To devise simple and relatively efficient ways of coding and storing the kinds of data usually collected by schools that would lend themselves to the study of the cumulative effects of the educational environment on the pupils who pass through it.
2. To analyze in a number of different ways the data collected and organized in the school system under study in hopes that some indications of the relative

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stability of the educational environment could be found and that the affect of gross environmental change could be noted.

3. To examine the usefulness of a number of measurement instruments to see which of them might be most sensitive to gross institutional change and which, therefore, might be most useful as indices of changes taking place in the educational setting.

PROCEDURE

1. Population Studied

The study was focused on the pupils and teachers of the Kent State University School of Kent State University. The total pupil population of the school in the academic year 1964-65 numbered 658 in classes including kindergarten through grade twelve. The organization for instruction included one section each of grades one through eight with average enrollments of twenty-eight pupils. The population of classes nine through twelve ranged from eighty-eight for grade nine to one hundred for grade twelve. The faculty for the same year included thirty-eight full-time and eleven part-time instructors.

2. **Types of Data Gathered**

The instruments employed in data gathering were as follows:

	Instruments	Grades
a.	Lorge-Thorndike Intelligence Test	3-12
b.	California Achievement Tests	9-12
c.	Iowa Test of Basic Skills	3-8
d.	Iowa Test of Educational Development	9-12
e.	Cumulative Grade Point Average	9-12
f.	Minnesota Tests of Creative Thinking	9-12
g.	Rokeach Dogmatism Scale	9-12
h.	Taylor Manifest Anxiety Scale	9-12
i.	Michigan State M Scales	9&12
j.	Junior Index of Motivation (Frymier)	9-11
k.	Ohio Picture Preference Scale (Frymier)	9-11

Faculty members of the school completed the Minnesota Tests of Creative Thinking, The Rokeach Dogmatism Scale, and the Taylor Manifest Anxiety Scale, and these data were used in the study.

3. The data processing system involved the development of two basic card designs. For each pupil, an identification card was prepared which reserved space on a standard eighty column IBM card as follows: Columns seventy-five through eighty were reserved

for an IBM code number assigned to each pupil or teacher, six digits being sufficient for numbering this size population. Columns fifty-one through seventy-four were reserved for alphabetic coding of first and last names. Columns forty-nine and fifty were reserved for the indication of the number of one of several cards belonging to a particular student. Columns forty-seven and forty-eight were reserved for the last two digits of the year in which the data were recorded. Columns forty-five and forty-six were reserved for the last two digits of the year the pupil entered the school. Columns forty-three and forty-four carried the last two digits of the year in which the individual was expected to graduate, and column forty-two carried a code indication of the sex of the pupil. Column forty-one carried an 0-2-8 punch which was a code that indicated to the data processing equipment that all information to the left of the code was to be processed as variables.

Additional cards for each pupil carried in columns fifty-six through eighty the student code number, last name, the card number of this particular set of student cards, and the sex of the student. On these subsequent cards, the 0-2-8 punch was entered in column fifty-five.

On all cards, fields of four digits were marked off to contain the scores for data on the variables under study. A blank column was left between each of these data fields.

In general, a separate card was used to record data for test batteries that yielded a series of part scores. Tests yielding a single score were entered on space available on the basic identification card or other cards as needed.

Color coding was employed to simplify the handling of the cards.

This system, being open-ended allowed for the addition of new cards each year or when new data were collected in a particular year.

4. Analysis Employed

The data collected during the course of the study were treated in the following ways:

a. Achievement test data for intact groups of pupils were plotted graphically and examined for possible relationship with institutional change and interpreted in terms of the relative stability of educational growth within the school.

b. The scores of individual pupils included in the longitudinal study described in a. above whose scores fell one standard deviation above or below the longitudinal mean were plotted graphically, and the relationships of these growth curves to the data for the total group in a. above were studied.

c. Achievement test data for a series of classes were plotted graphically at a specific point in time, and these graphs were examined for possible relationships to institutional aspects of change or stability.

d. Variables employed in the study were organized into tables of means and standard deviations by class and by sex and examined for possible interrelationships among the variables.

e. Dichotomized pupil groups were established in terms of their score on a particular variable falling above or below one standard deviation above the mean. The differences between these groups in terms of other variables were tested using the Chi-square statistic.

f. Mean scores and standard deviations of data gathered on faculty members were compared with corresponding information available for students.

5. Results

a. The data collection and storage system developed proved to be a satisfactory means of handling information customarily collected by school systems.

b. The longitudinal analysis of achievement test scores suggested that the educational system under study has been highly stable over a long period of time.

c. The cross-sectional analysis of the achievement of different pupil groups at the same level in the educational system showed some variability among classes that could not be accounted for in terms of differences in I.Q. or in terms of differences in teachers.

d. Of the several variables employed in the secondary school phase of the project, three appeared to have considerable promise for continued use. Of the personality variables checked, the Rokeach Dogmatism Scale was most closely related to achievement. The Taylor Manifest Anxiety Scale appeared to be sensitive to changes in student morale that may have been effected by gross institutional change. The Minnesota Creativity Test did not appear to be related in any consistent fashion to any of the other variables employed in the study.

The Michigan State M Scale total score showed consistent positive correlations with achievement, but the potential of this instrument for use in assessing stability or change was not tested sufficiently in this study to make possible any adequate judgment on its usefulness. Further analysis using the separate factor scores is needed.

e. The small quantity of data collected from faculty members indicate that in terms of mean scores they, as a group, are slightly more creative than the pupils in the school, considerably less dogmatic, but much more anxious.

Conclusions

1. The systems' approach to the collection, storage, and analysis of data on the operation of a school system appears to be successful enough to warrant continuation of the system over a long time span.
2. Enough evidence of long term stability of institutional operation was found to support the notion that adequate base lines of steady-state functioning can be developed. It is believed such base lines

can be used in advanced designs for the measurement of the effects of gross institutional change.

Bibliography

Twenty-seven references have been listed in the final report.

Publications

At this time no publications based on this study have been submitted.

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Figure 5

Growth Charts Based for Reading Means on the
Iowa Test of Basic Skills, Grades Four Through Nine

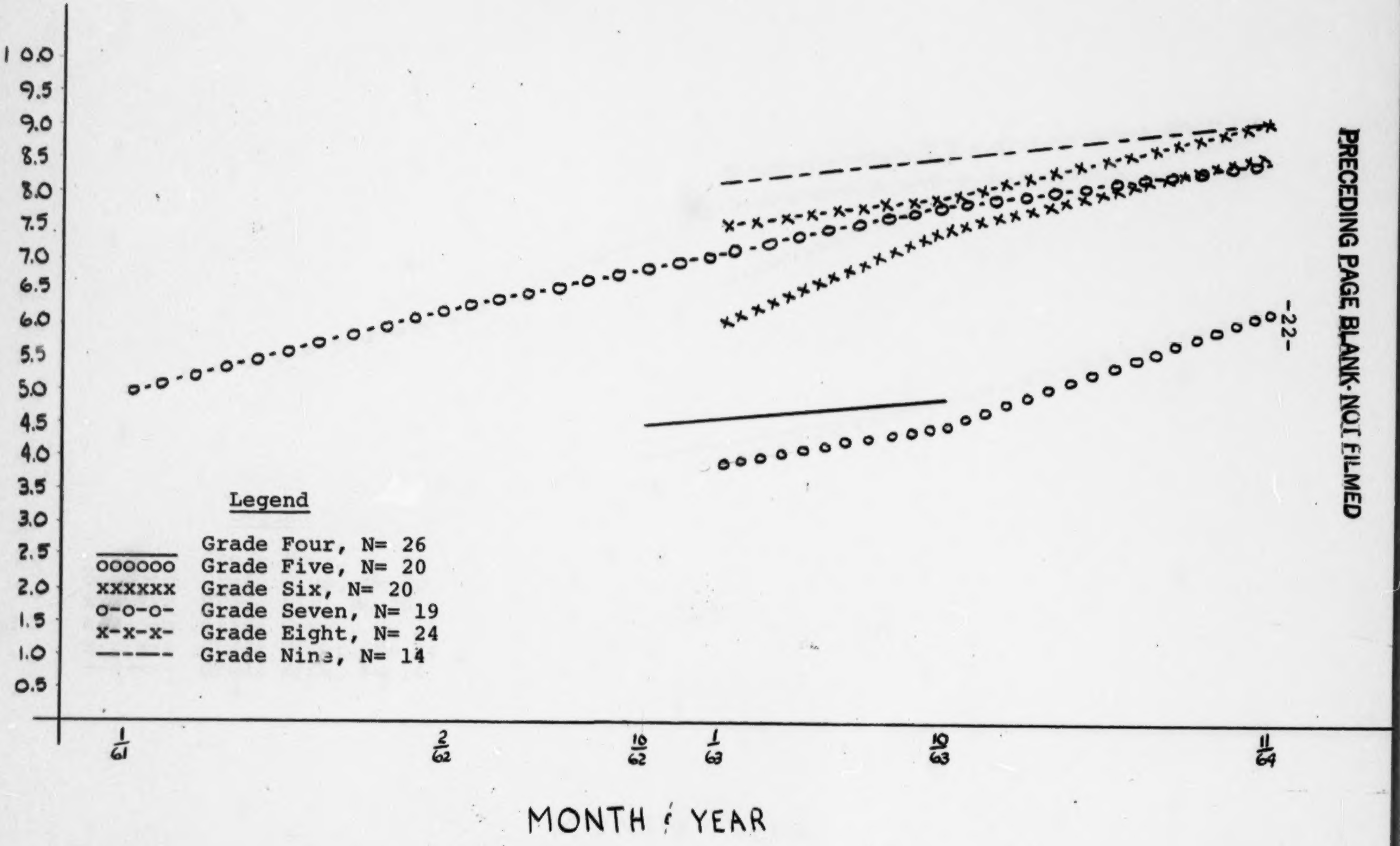


Figure 6

Growth Charts Based on Mean Scores for Language on the *Iowa Test of Basic Skills*, Grades Four Through Nine

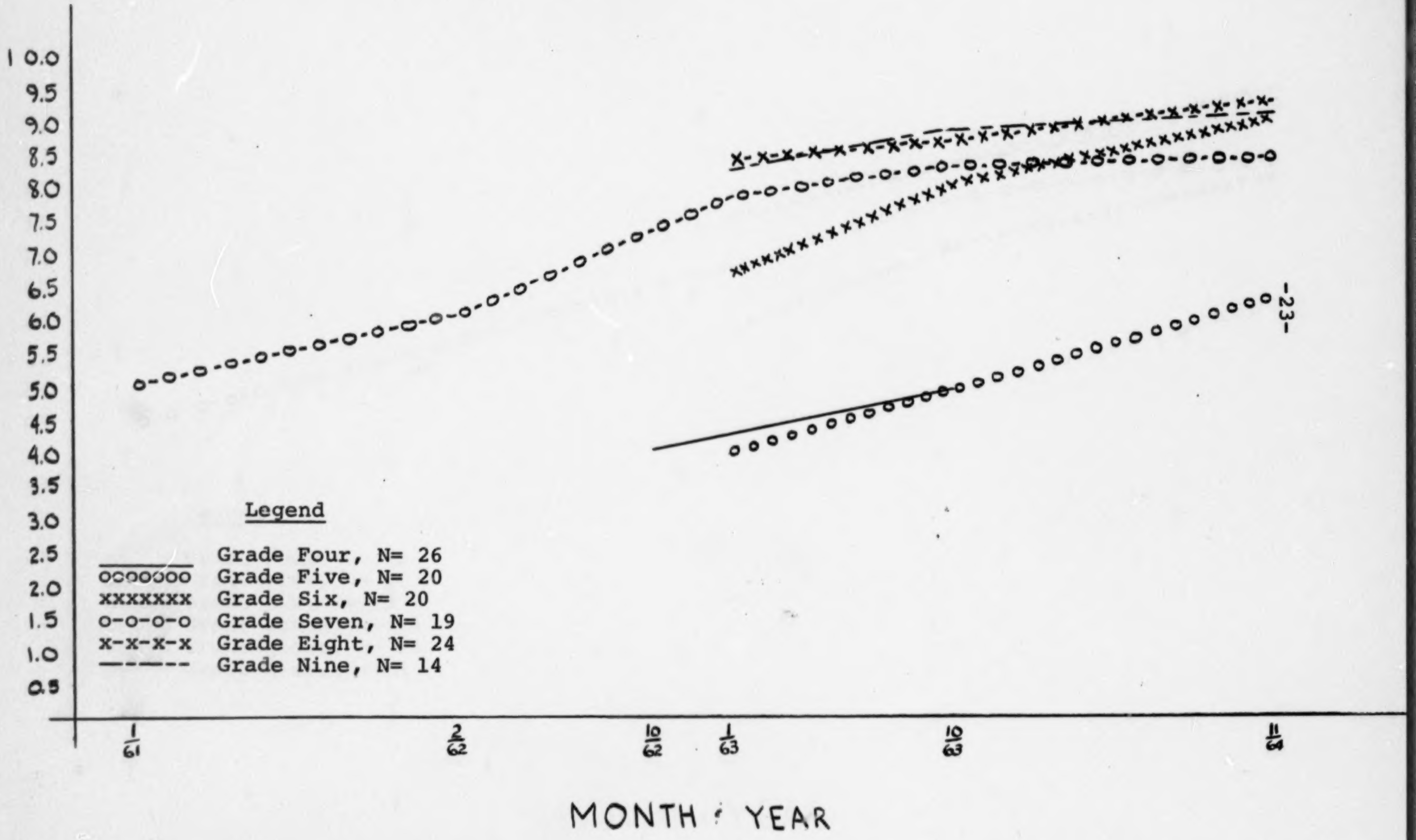


Figure 7

Growth Charts Based on Mean Scores for Work Study Skills on the *Iowa Test of Basic Skills*, Grades Four Through Nine

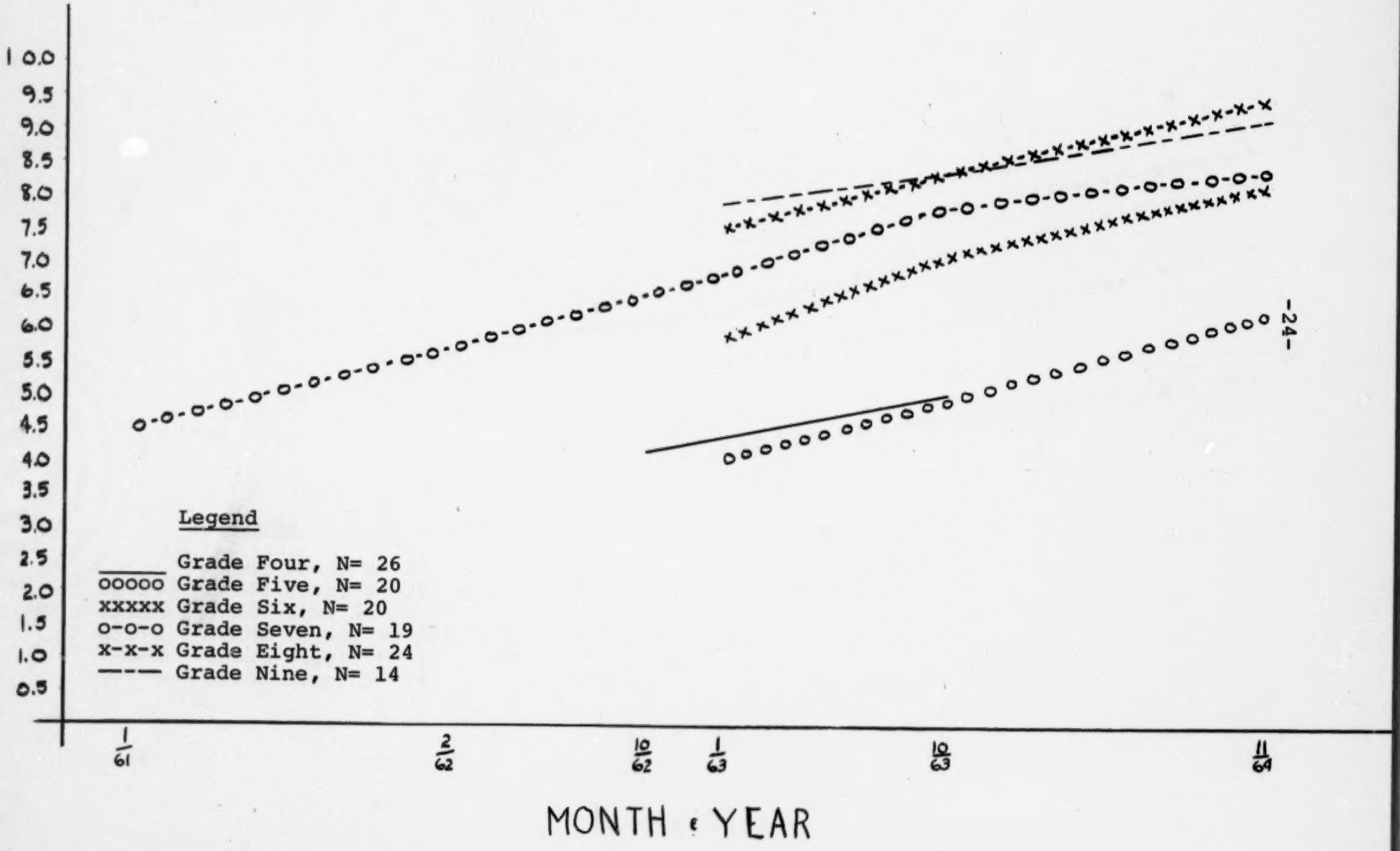
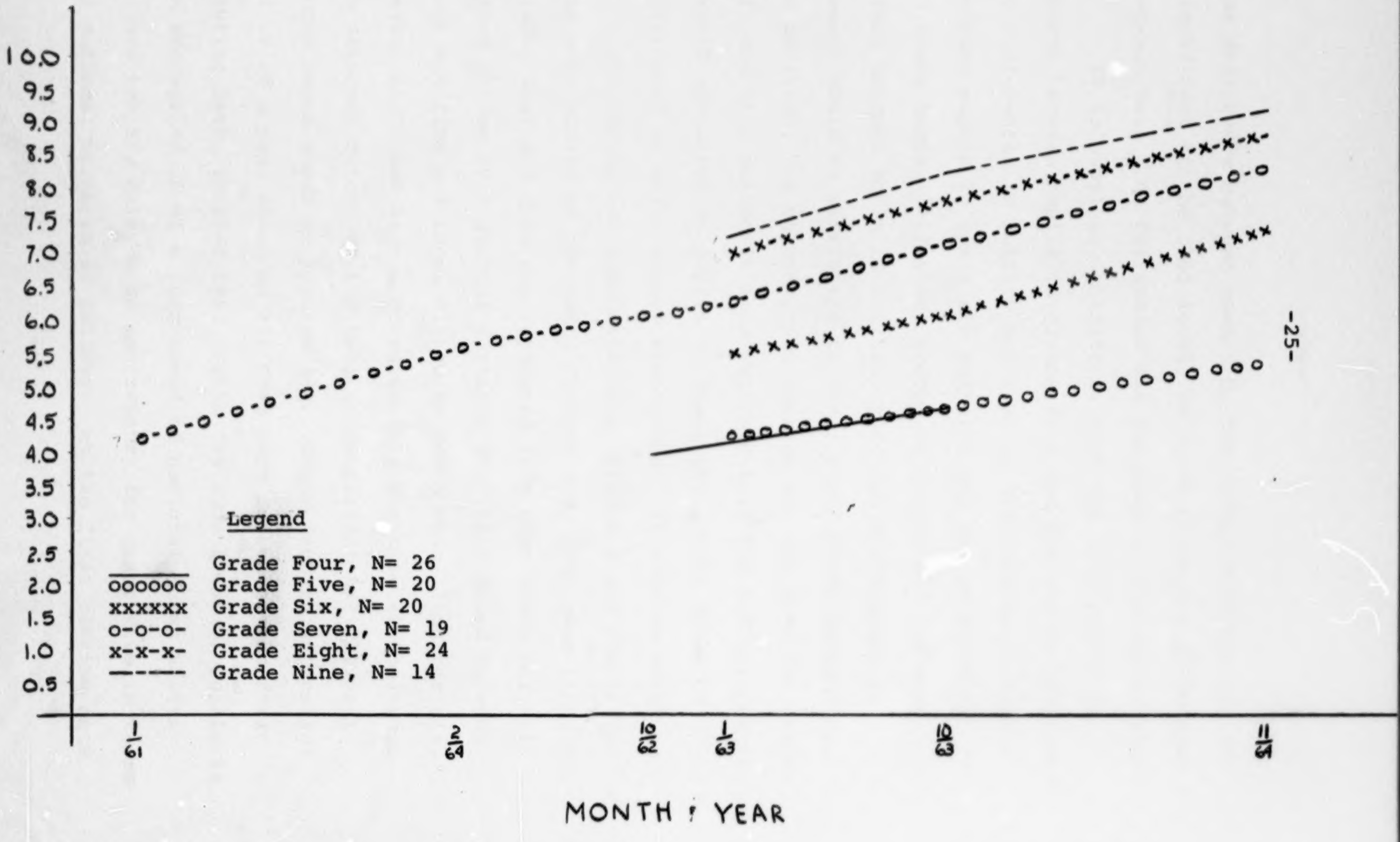


Figure 8

Growth Charts Based on Mean Scores for Arithmetic on the Iowa Test of Basic Skills, Grades Four Through Nine



The difference between mean I.Q. for grades four and six is significant at the .005 level, t= 3.15, while the difference between mean I.Q. for grades six and nine is non-significant.

It is possible, therefore, that the differences in growth between pupils in grades four and six may be attributed to differences in ability but similar differences in growth between pupils in grade six and nine may not be accounted for in these terms. All three groups of pupils had the same first grade teacher so it is unlikely that the differences in growth could be attributed to their first grade experience. In addition, the second grade teacher was the same for grades six and nine making it more unlikely that the differences in growth exhibited by pupils in these two grades could be attributed to early school experience. It will be noted on both the charts for composite mean, Figure 3 and charts for the part scores of the test, Figures 4-8, that mean lines for grades four and five are separated from mean lines for all other grades by a greater distance than that found between four and five and those distances among mean lines for six, seven, eight and nine. Moreover this position with respect to national norms for the test is consistant for all part score means shown on Figures 4-8. Grade four is an average of .9 of a year ahead on all five part scores at the first testing date, October 1963, while the same group of pupils is an average of .6 of a year ahead of national norms at the second testing date. The descrepancy for grade five in terms of national norms is as follows: at the first testing date

January '63, the group was .52 of a year ahead of national norms, at the October '63 testing date the group was .54 of a year ahead, and at the November '64 testing date the group had moved their mean achievement scores an average of 1.1 year ahead of national norms. By way of contrast, grade six pupils at the same three testing dates as grade five were 1.6 years, 1.8 years, and 1.98 years ahead of national norms.

Again it must be pointed out that the discrepancies observed cannot be accounted for in terms of differences in mean intelligence quotient. The mean I.Q. for the twenty-six pupils in the grade five group is 113.3 as contrasted with a mean of 114.7 for grade six. In addition, the growth curve slope for grade five 1.091, is the steepest one observed next to grade six.

While all three of these grades were taught by the same first grade teacher, both grades four and five had a second grade teacher different from the one who taught grade six at this level. Unfortunately no achievement data for these early grades were available so it is not possible to say whether the discrepancy was present from the beginning of the schooling given grades four and five or whether a shift in growth rate occurred at some other point earlier than the time for which data are available.

Longitudinal Data Derived From the California Achievement Test

Similar longitudinal charts based on data obtained from administrations of the California Test are included in Appendix B. In general, these charts suggest that the small groups of pupils who began their work in first grade in the University School grew in achievement at a quite similar rate. The slopes of these lines cannot be properly compared to the similar charts derived from the Iowa testing, and the small number of subjects in each group makes any interpretation of trends hazardous. There is, however, some indication that the early academic progress of these groups of pupils was steady and that there was little difference among the groups in terms of the initial measurements of their progress and their respective growth rates.

Longitudinal Data Shown in Terms of Means, Standard Deviation and Range

Figures 9 through 14 on the following pages illustrate growth in achievement for grade seven, class of 1970 in terms of group mean, standard deviation, and range of scores. These data were collected over a five year period and were derived from administrations of the Iowa Test of Basic Skills.

Looked at as a group, these charts exhibit a remarkable picture of stable and steady growth. Mean lines show little change in slope over the five year period and standard deviations do not change markedly from the initial to the final testing period. Even more surprising is the fact that the extremes of the range of scores tend to reflect the mean rates of growth. It would be reasonable to expect the slower learning students to progress at a slower rate, but this does not seem to be the case. Neither is there any indication that the more able students accelerate in their rate of growth.

Figure 9

Longitudinal Representation of Composite Growth in Achievement for Grade Seven in Terms of Mean, Standard Deviation and Range, Iowa Test of Basic Skills

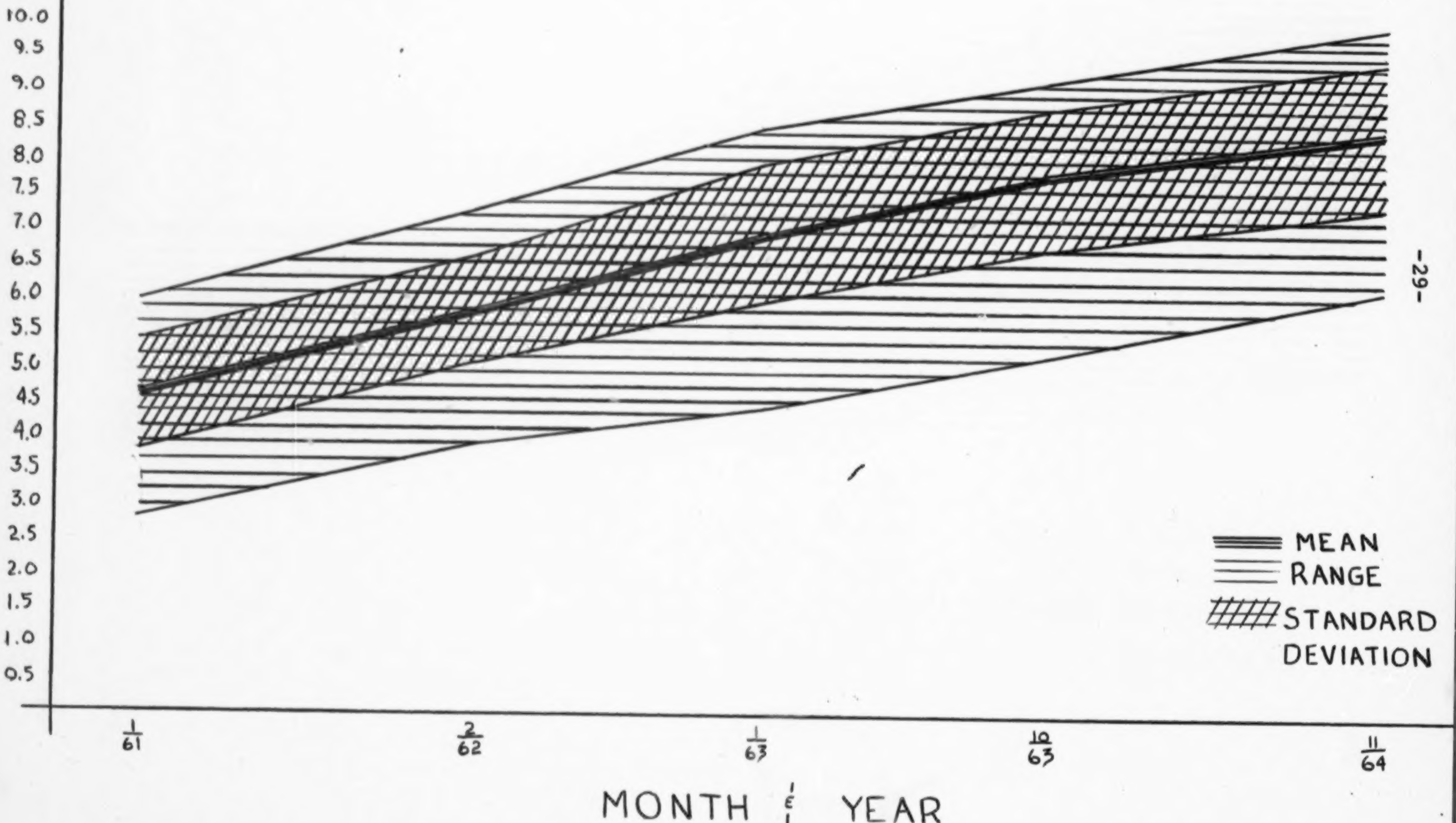


Figure 10

Longitudinal Representation of Vocabulary Growth for Grade Seven
in Terms of Mean, Standard Deviation and Range, Iowa Test of Basic Skills

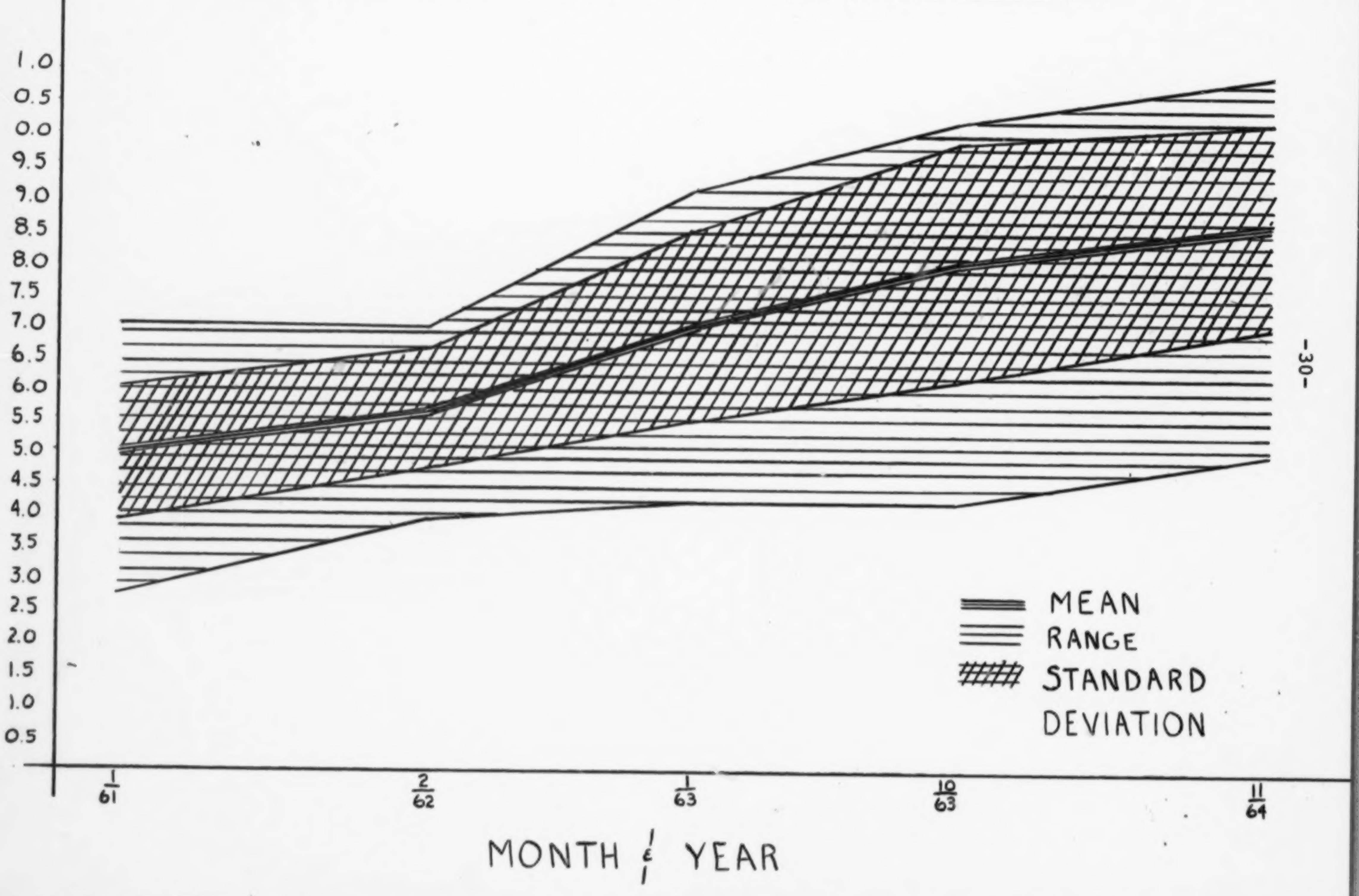


Figure 11

Longitudinal Representation of Reading Growth for Grade Seven in Terms of Mean, Standard Deviation and Range, Iowa Test of Basic Skills

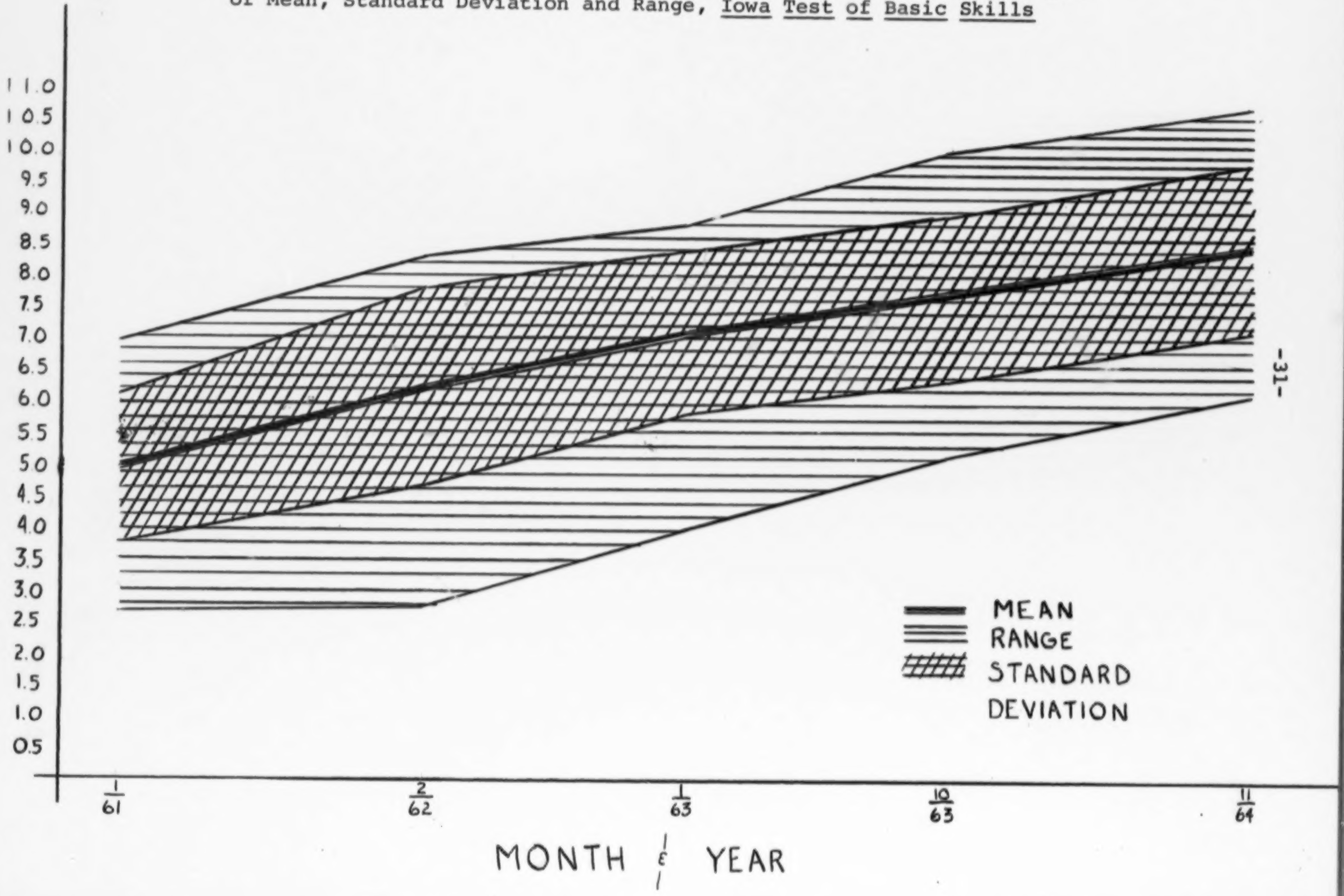


Figure 12

Longitudinal Representation of Growth in Language Ability for Grade Seven in Terms of Mean, Standard Deviation and Range, Iowa Test of Basic Skills

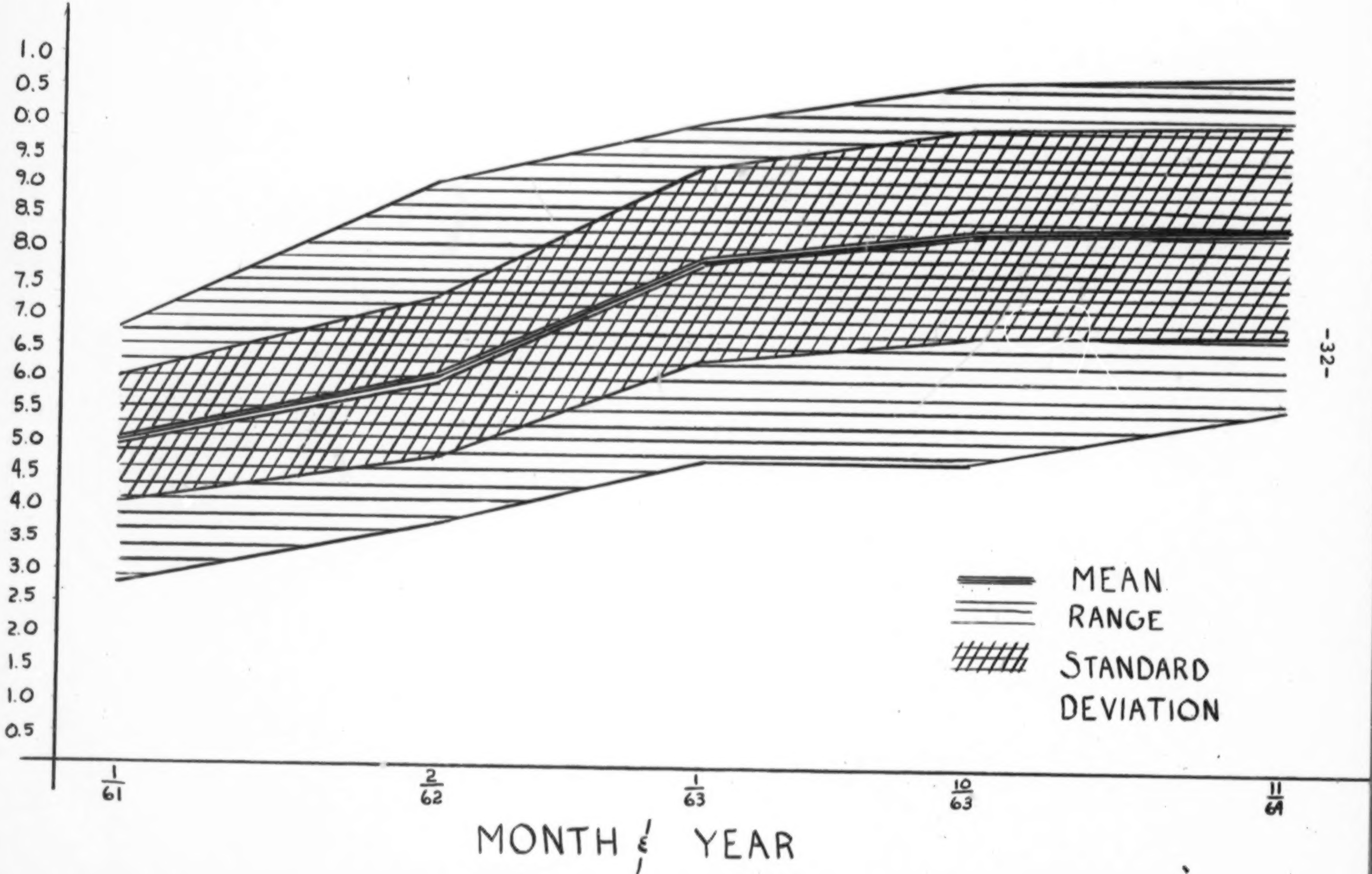


Figure 13

Longitudinal Representation of Growth in Work Study Skills for Grade Seven in Terms of Mean, Standard Deviation and Range, Iowa Test of Basic Skills

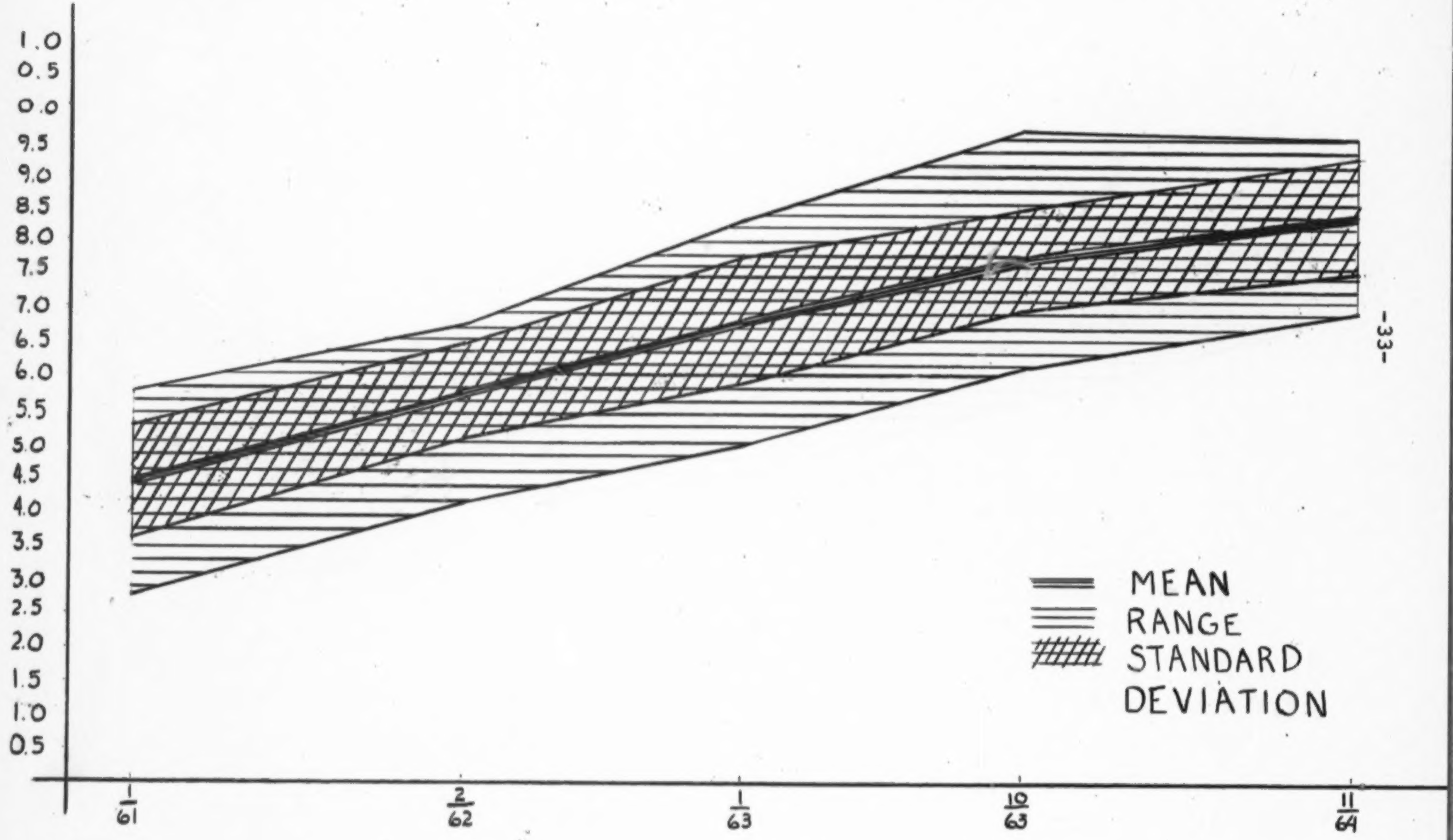
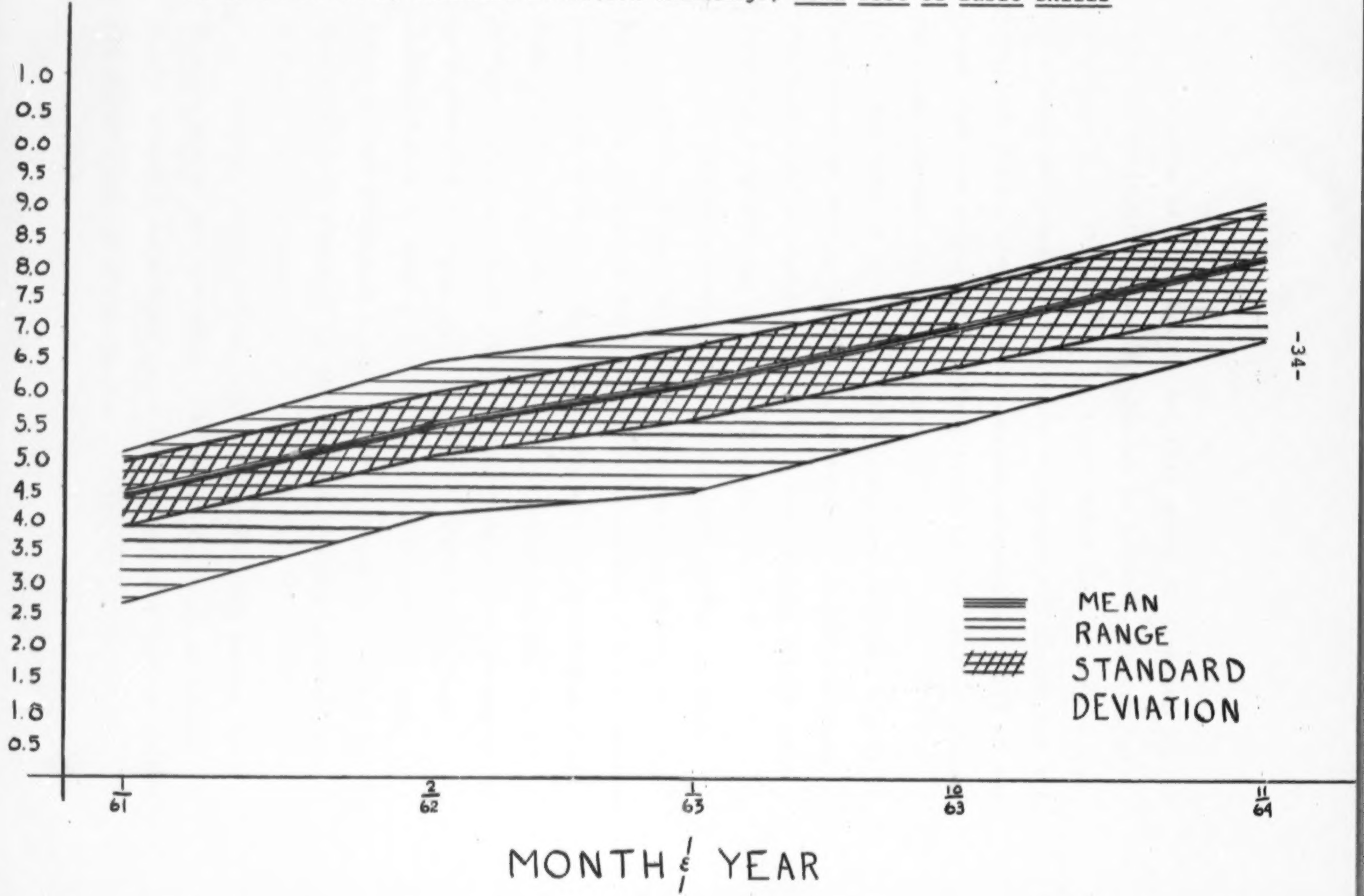


Figure 14

Longitudinal Representation of Growth in Arithmetic Ability for Grade Seven in Terms of Mean, Standard Deviation and Range, _Iowa Test of Basic Skills_



Graphs of part scores for this group of nineteen pupils exhibit interesting inconsistancies in growth. For example, in February of 1962 midway in their third year of schooling, the range and standard deviation of vocabulary scores was the smallest during the five year period, Figure 10, while at the same time the range and standard deviation in reading, Figure 11, was greatest for this period.

The rate of growth in vocabulary acquisition, Figure 10, and language skill, Figure 12, appeared to accelerate from February 1962 to January 1963 while the reading growth rate remained constant for this same period.

It is also interesting to note that growth in work study skills, Figure 13, appeared to decline during the time this group of pupils was in grade six, October 1963 to November 1964. The teacher at this level appears to spend more class time working at study skills than any other teacher in the system. Children under this teacher's direction do appear to gain markedly in their ability to work methodically and independently in this grade yet the growth line for work study skills indicates a decline at this point. Evidently the kinds of gains produced by the teacher are not adequately measured by this test.

Additional charts of composite scores for grades four through twelve are included in Appendix C. None of these charts includes more than three testing periods and no trends are discernable in these charts.

Longitudinal Data for Individual Pupils

Since growth in terms of range of scores in the preceding graphs did not indicate the progress of individual pupils, it seemed useful to check further on the progress of individuals in these groups at the upper and lower ranges of achievement. Pupils in each class were selected for further study in the following manner: Composite scores for each pupil for each separate testing period were averaged and the standard deviation for these average scores for each group was computed. Those pupils whose average score fell one standard deviation above or below the group mean of average composite scores were studied individually. Graphs of the composite scores on the Iowa Test of Basic Skills are shown in Figures 15 through 20.

In only two cases is retrogression in achievement noted in Figure 15. Pupils A and C lost instead of gained in composite achievement while pupil E in the same class showed neither a gain nor loss. These pupils were in grade three during the period covered by the tests.

In the remainder of the charts, Figures 16-20, the graphic representation of pupils' scores indicates growth in composite achievement that is not markedly different at the extremes of the range of scores for each group. Growth rates for individuals roughly parallel mean growth rates for the respective groups. There is evidence of some of the effectiveness of specific teachers for specific pupils in the chart for grade seven, Figure 19, pupils C and D, January 1963 to October 1963, but no overall indication that any one teacher produces better achievement on the part of pupils they work

Figure 15

Longitudinal Representation of Individual Pupils' Growth in Composite Achievement from Grade Four, Class of 1973, Whose Scores Fell One Standard Deviation Above or Below Class Mean

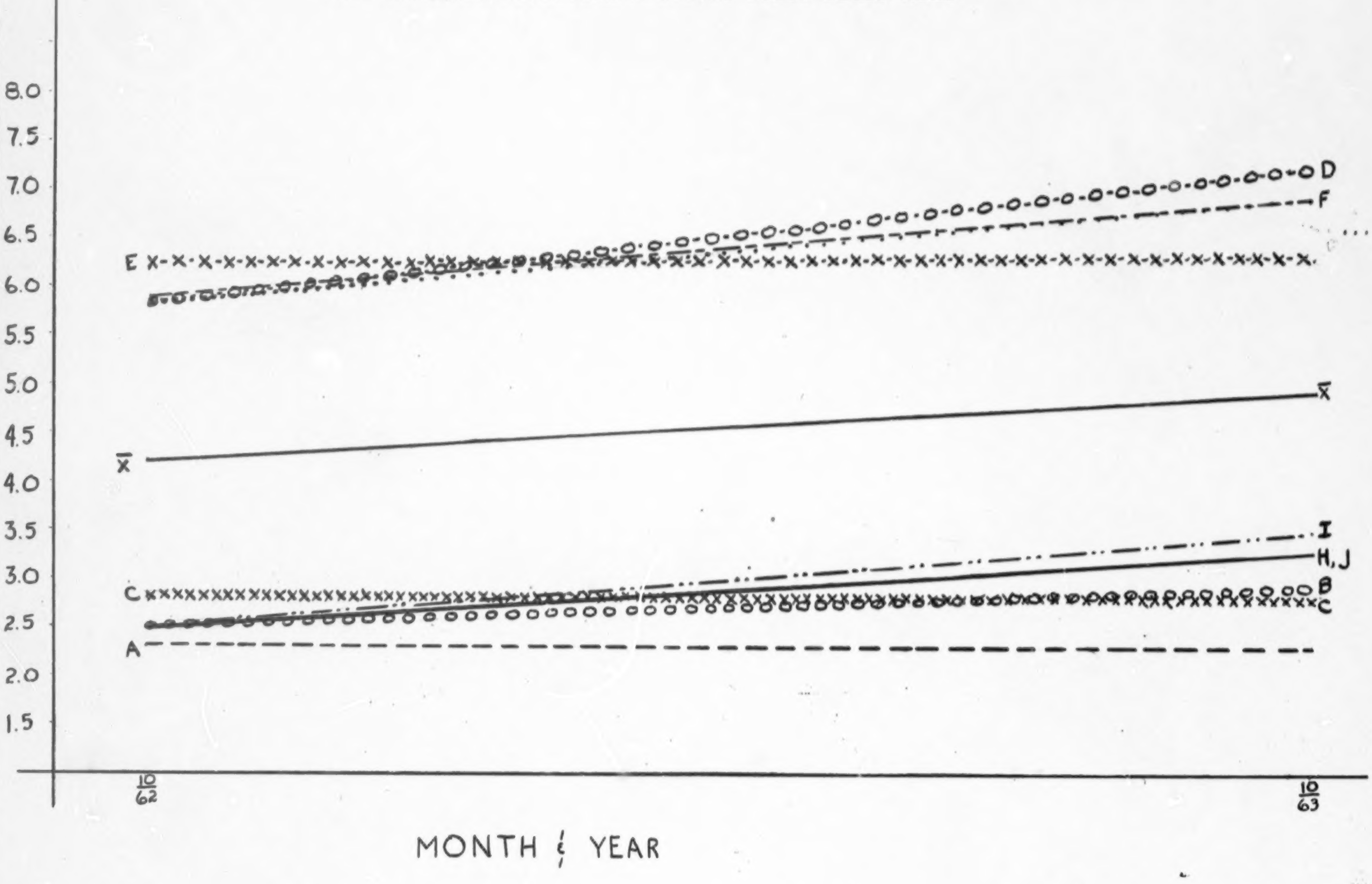


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Figure 16

Longitudinal Representation of Individual Pupils' Growth in Composite Achievement from Grade Five, Class of 1972, Whose Scores Fell One Standard Deviation Above or Below Class Mean

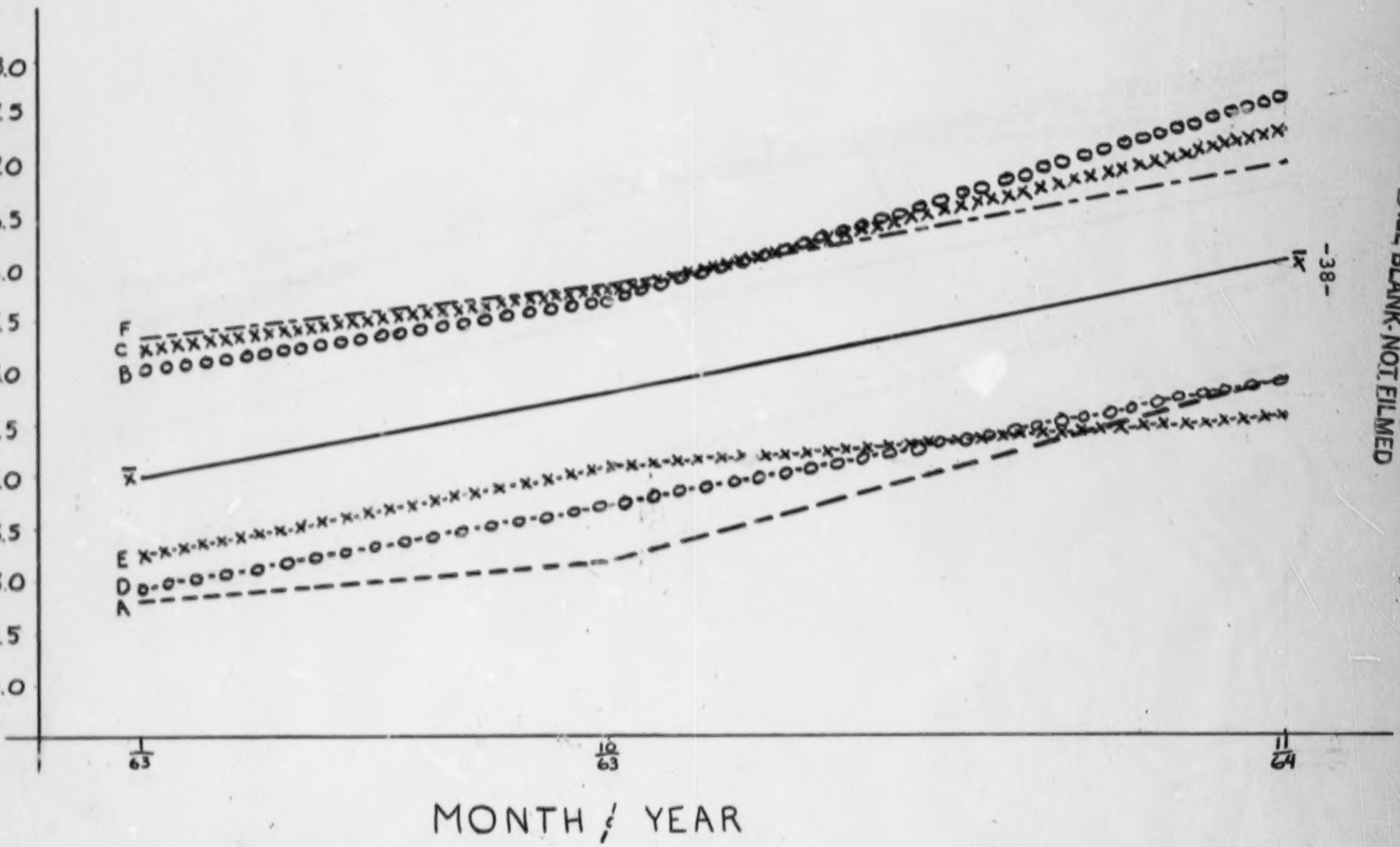


Figure 17

Longitudinal Representation of Individual Pupils' Growth in Composite Achievement from Grade Six, Class of 1971, Whose Scores Fell One Standard Deviation Above or Below the Class Mean

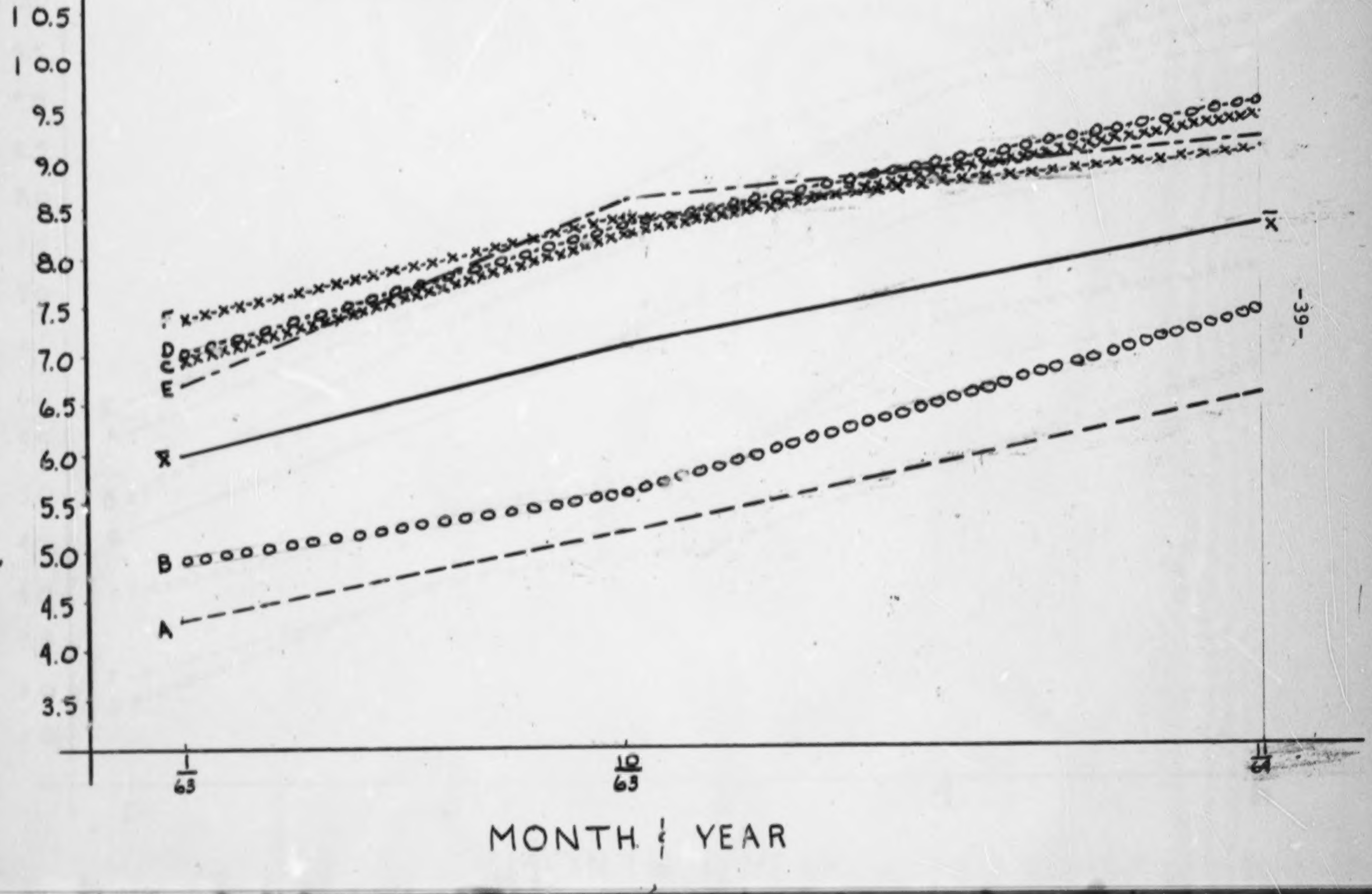


Figure 18

Longitudinal Representation of Individual Pupils' Growth in Composite Achievement from Grade Seven, Class of 1970, Whose Scores Fell One Standard Deviation Above or Below the Class Mean

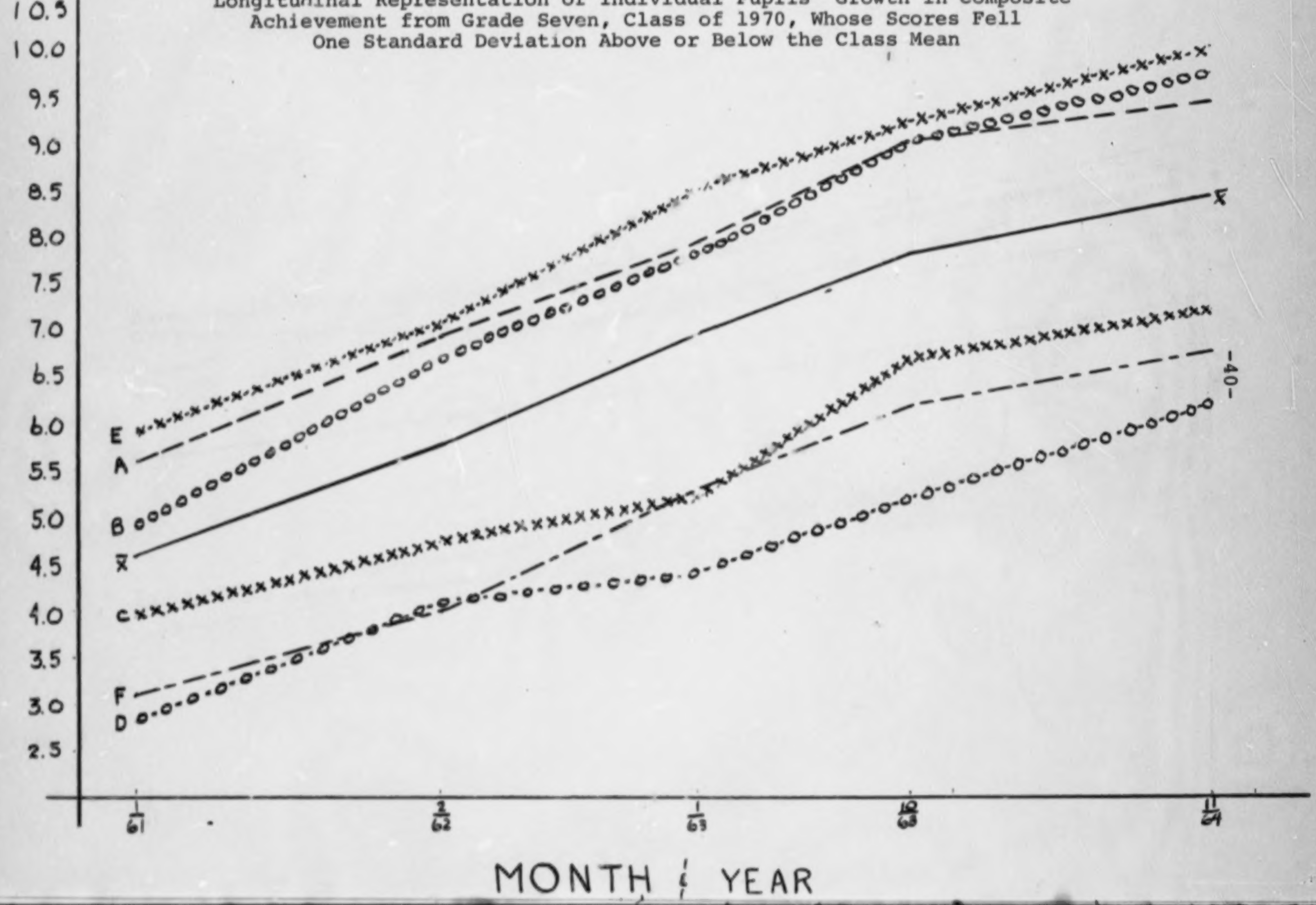


Figure 19

Longitudinal Representation of Individual Pupils' Growth in Composite Achievement from Grade Eight, Class of 1969, Whose Scores Fell One Standard Deviation Above or Below the Class Mean

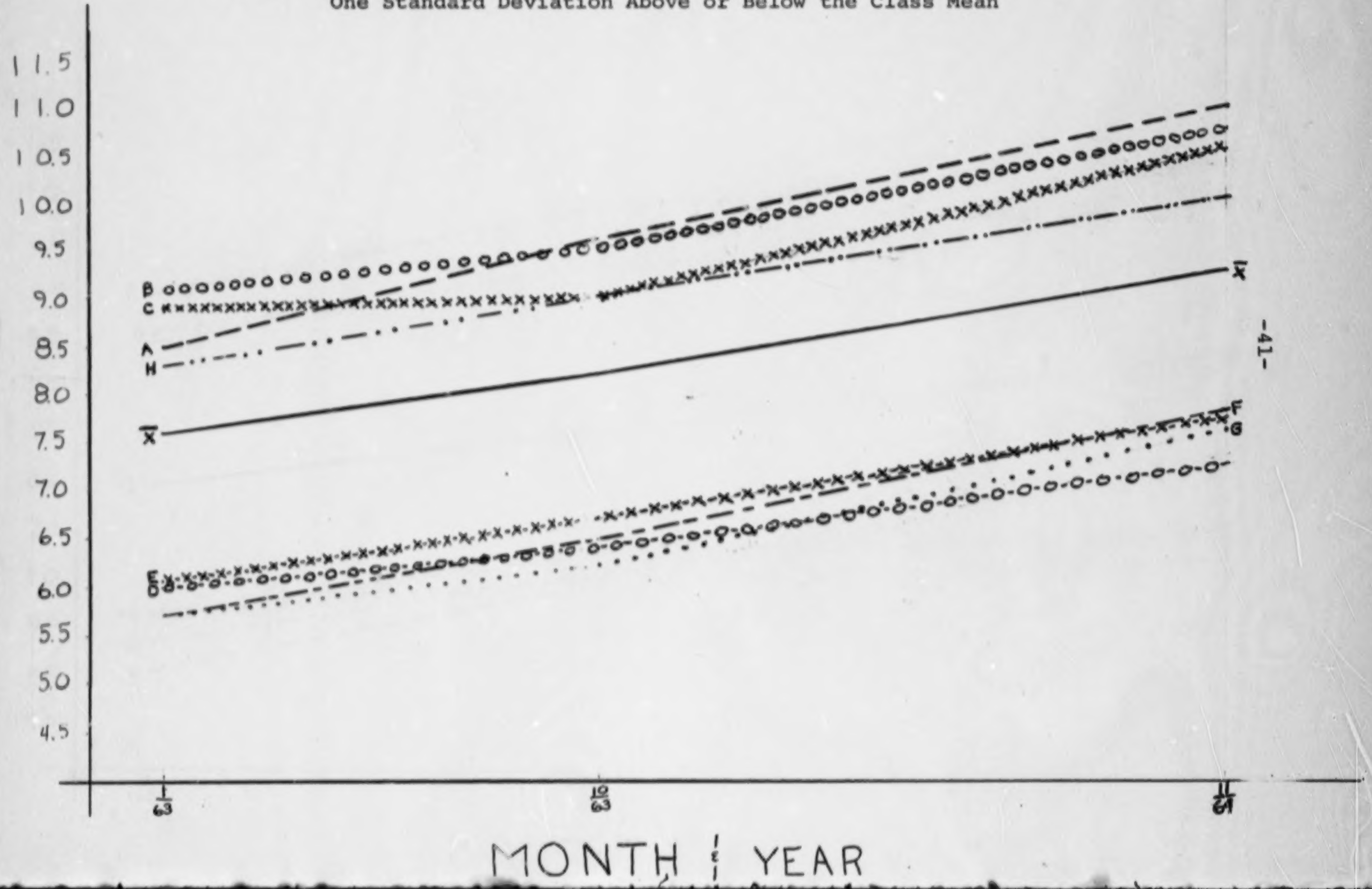
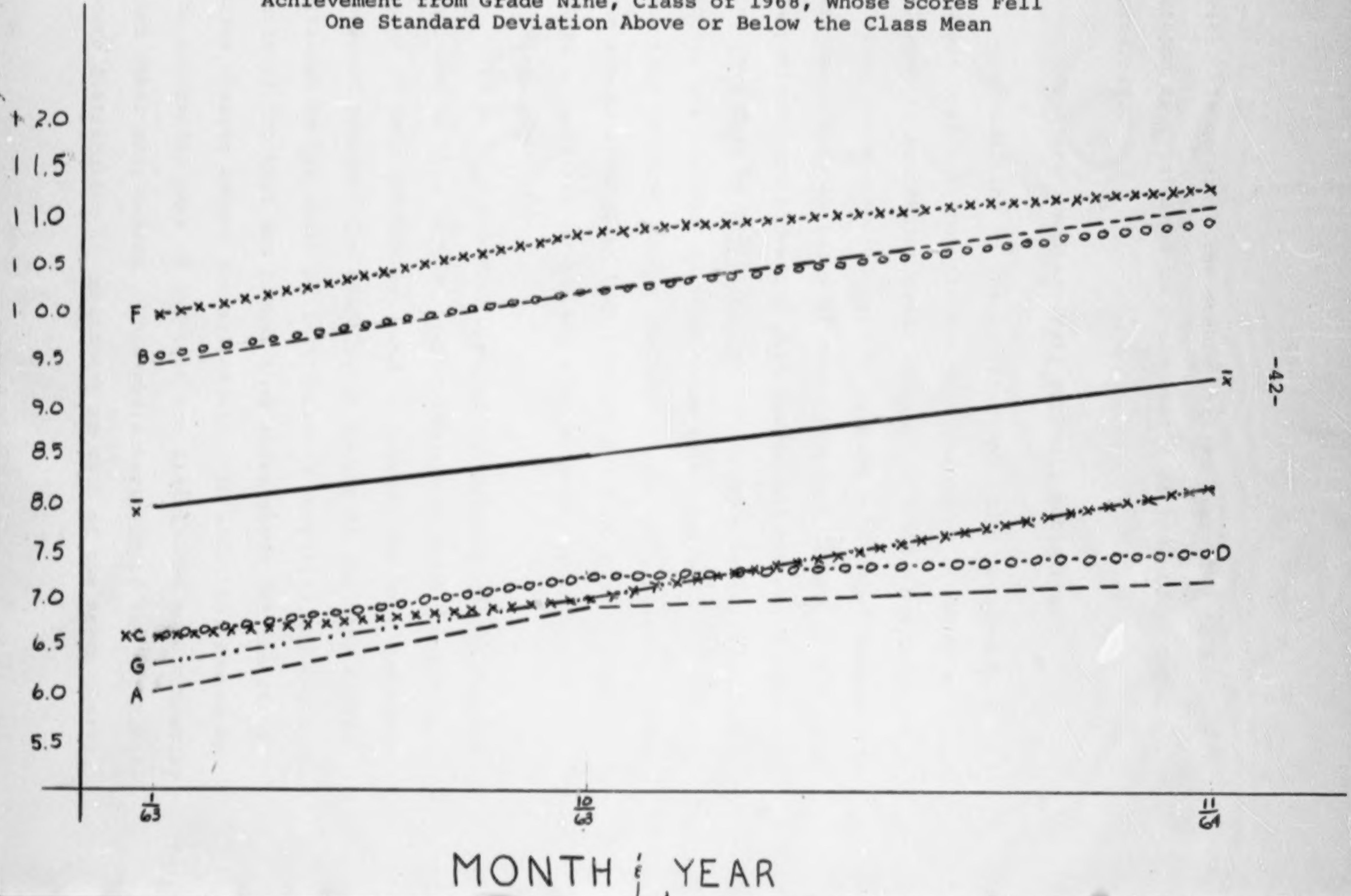


Figure 20

Longitudinal Representation of Individual Pupils' Growth in Composite Achievement from Grade Nine, Class of 1968, Whose Scores Fell One Standard Deviation Above or Below the Class Mean



with. In general, the stable pattern presented in earlier graphs is maintained in these charts of individual pupil progress.

Cross-sectional Analysis of Pupil Achievement

In addition to the longitudinal study presented, it seemed useful to compare the performance of a number of classes at successive grade levels. Figures 21 through 26 display these comparisons. It will be noted that comparisons are again made in terms of mean, standard deviation and range. Comparisons are shown for part scores and composite scores on the Iowa Test of Basic Skills. The groups of pupils whose scores are included in this cross-sectional analysis are not the same as those groups included in the longitudinal study. The scores studied in this section are from intact classes whose members may or may not have attended the school continuously.

It is apparent from a brief examination of the figures included in this section that differences among classes in terms of mean achievement tend to persist for both composite and part scores. For example, in Figure 21 the mean scores attained by the class of 1971 for both composite and separate parts of the test are higher than those shown for the other three classes except for arithmetic. In addition, scores on the arithmetic part of the test are distributed more compactly than other part scores. This characteristic of the arithmetic score distribution is consistant on each of the seven charts.

Figure 21

Cross-sectional Study of the Achievement of Four Classes in Grade Three in Terms of Mean, Standard Deviation and Range

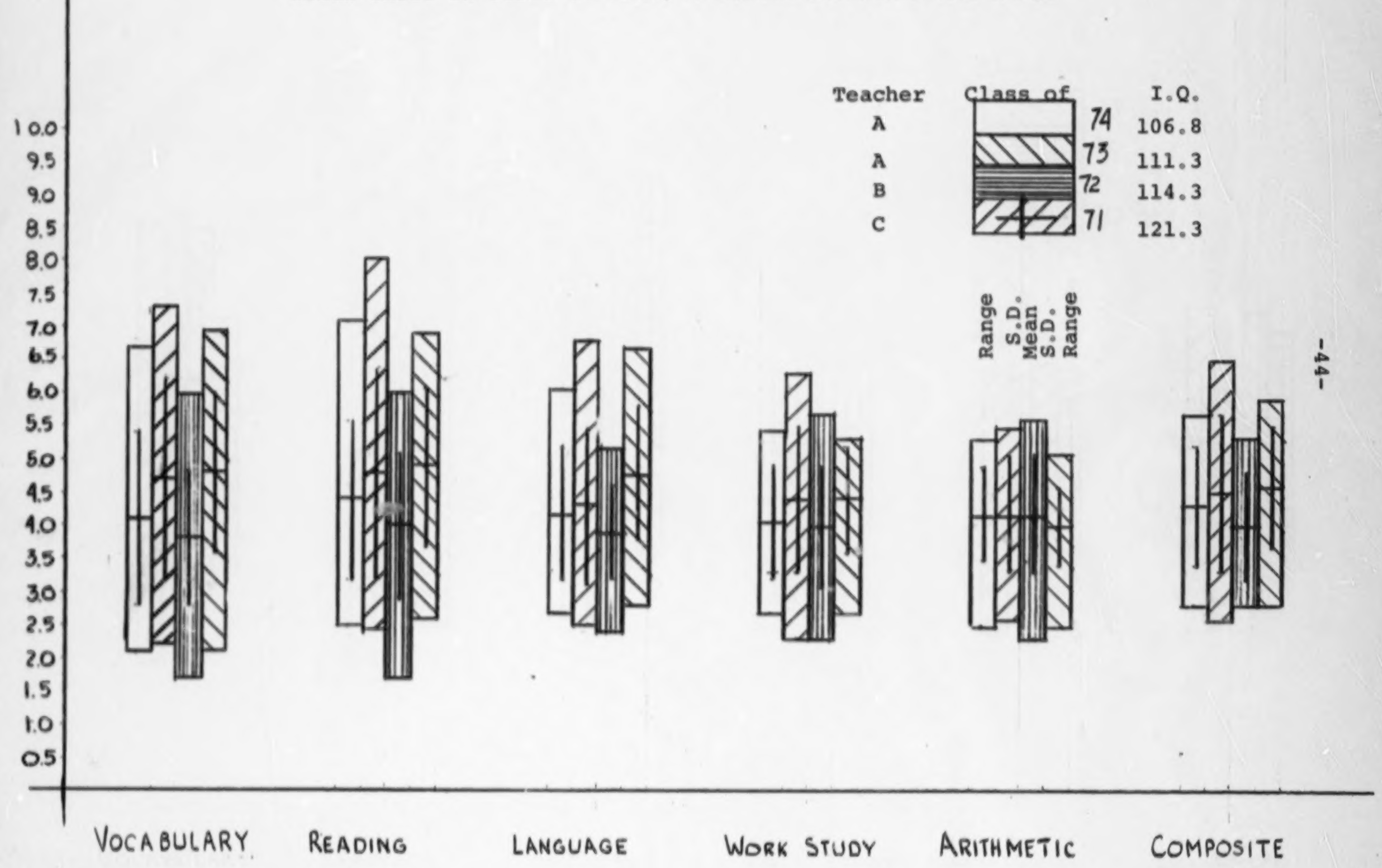


Figure 22

Cross-sectional Study of the Achievement of Four Classes in Grade Four in Terms of Mean, Standard Deviation, and Range

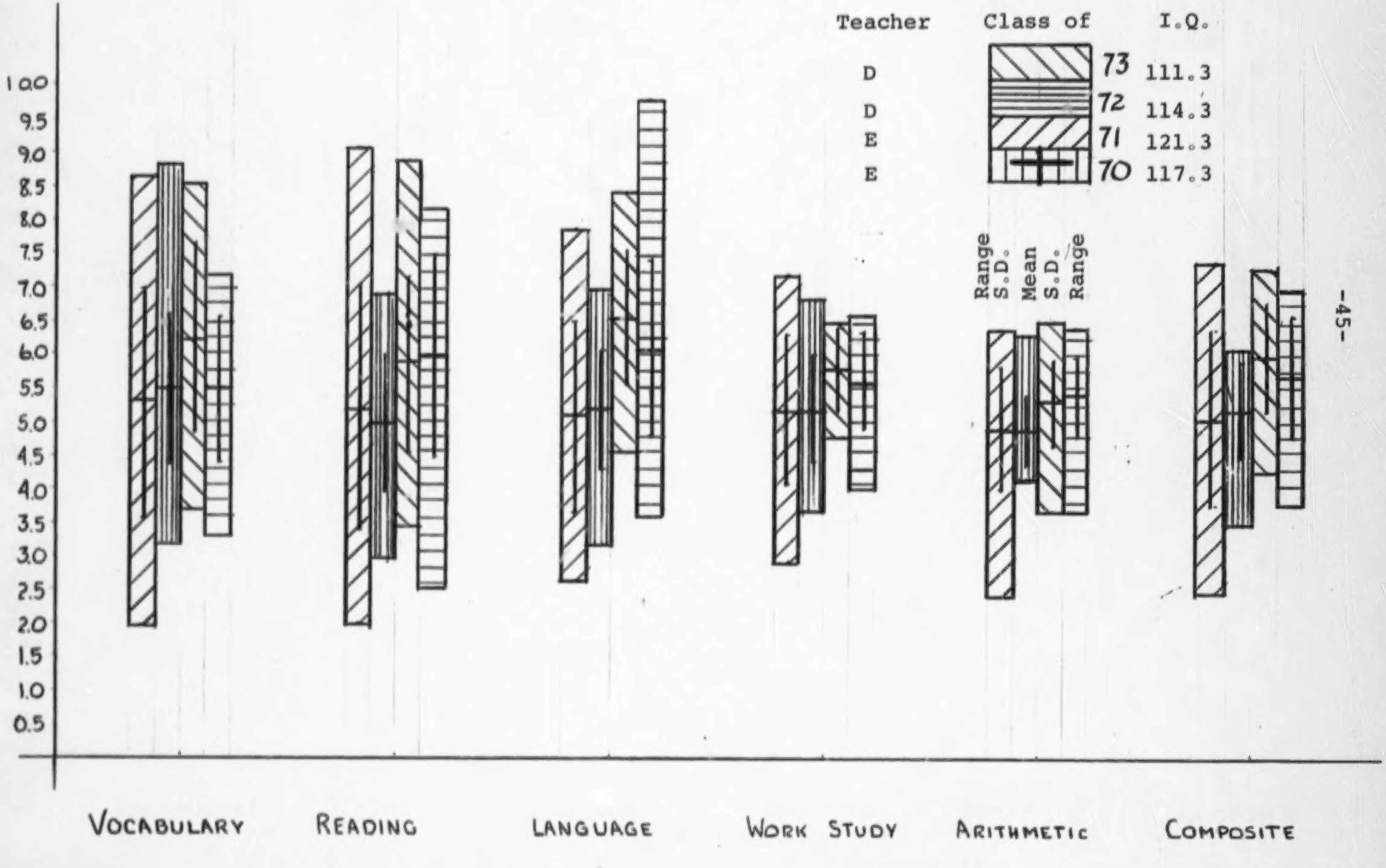


Figure 23

Cross-sectional Study of the Achievement of Three Classes in Grade Five in Terms of Mean, Standard Deviation and Range

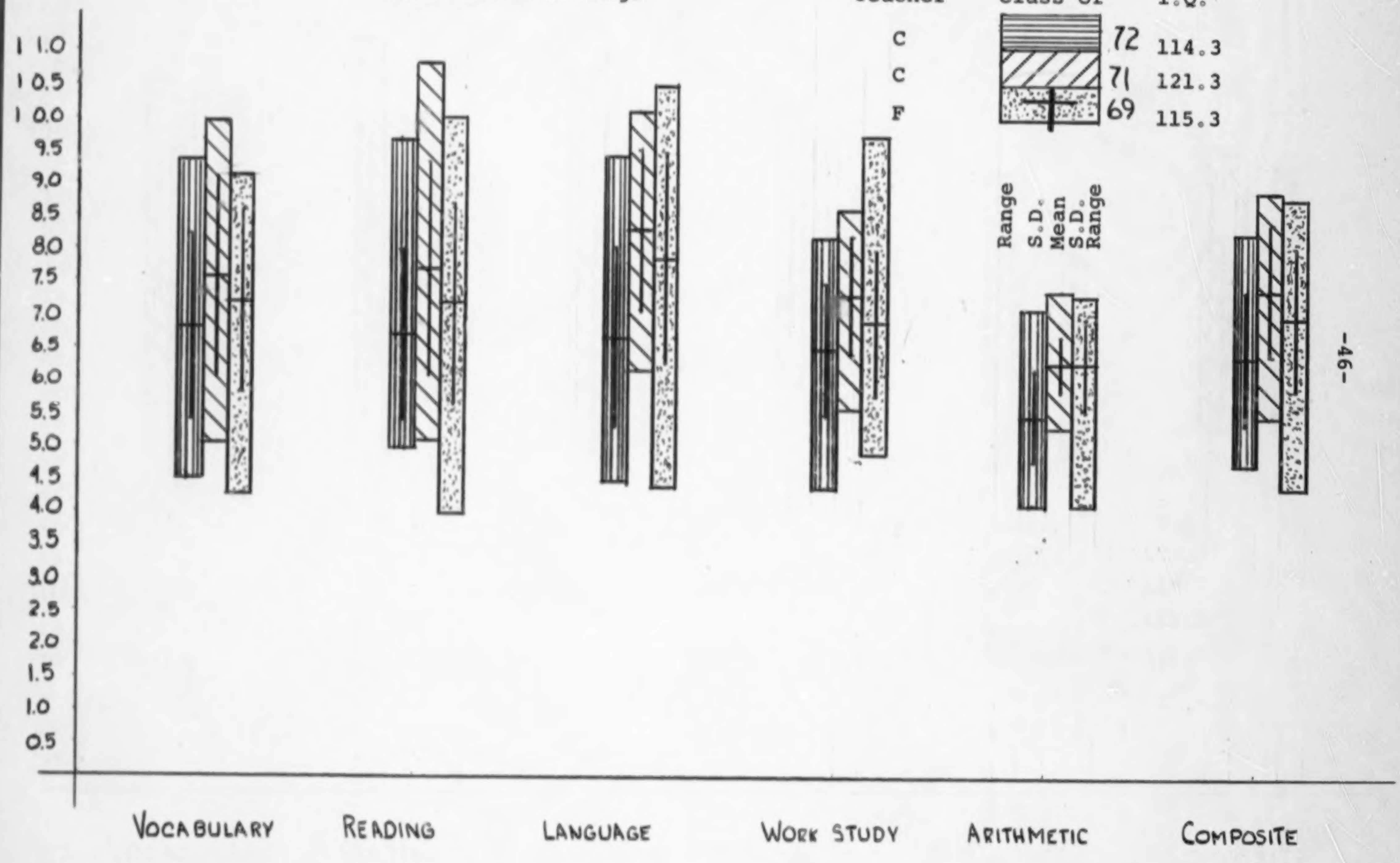


Figure 24

Cross-Sectional Study of the Achievement of Four Classes in Grade Six in Terms of Mean, Standard Deviation and Range

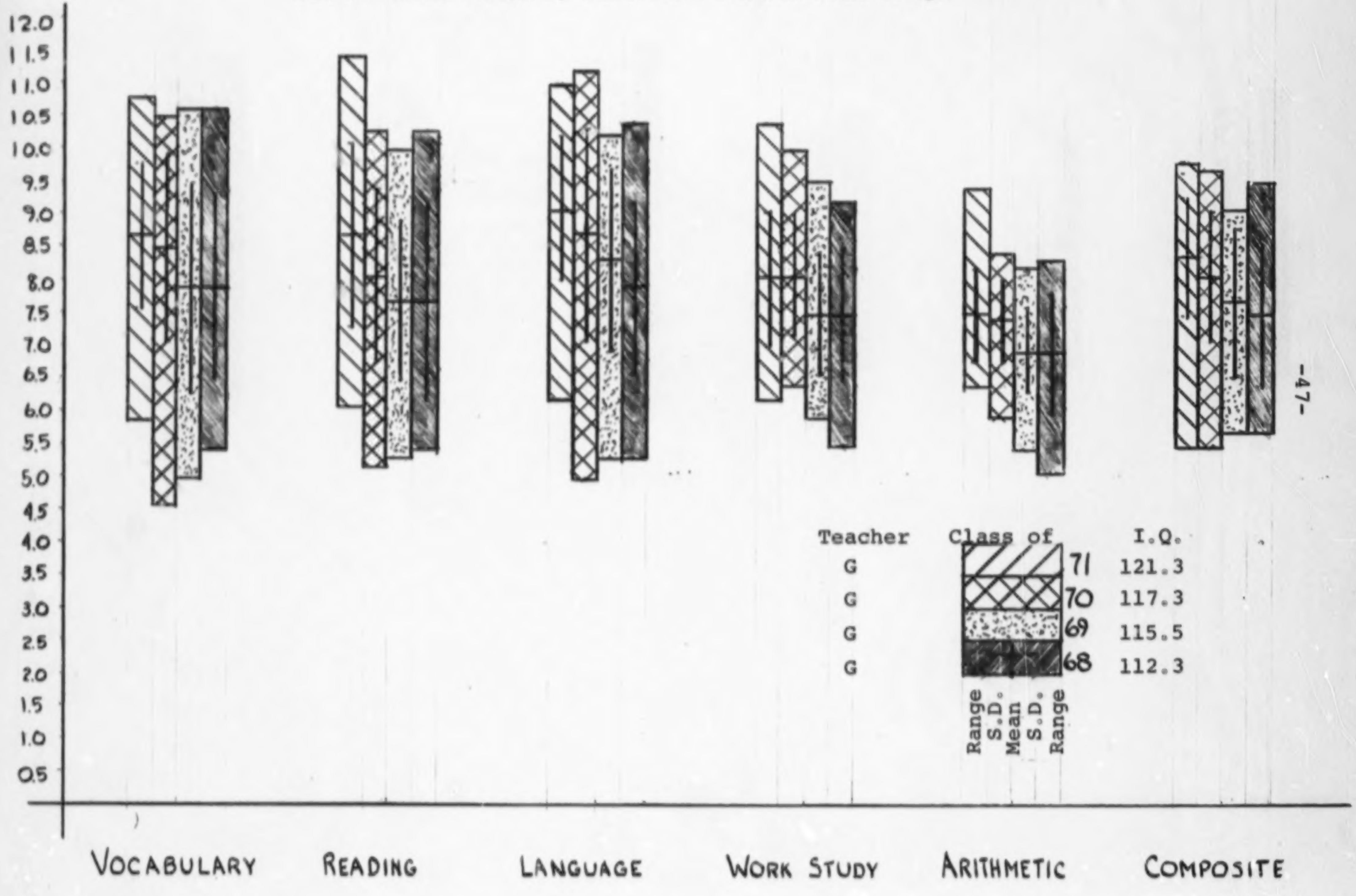


Figure 25

Cross-Sectional Study of the Achievement of Three Classes in Grade Seven in Terms of Mean, Standard Deviation and Range

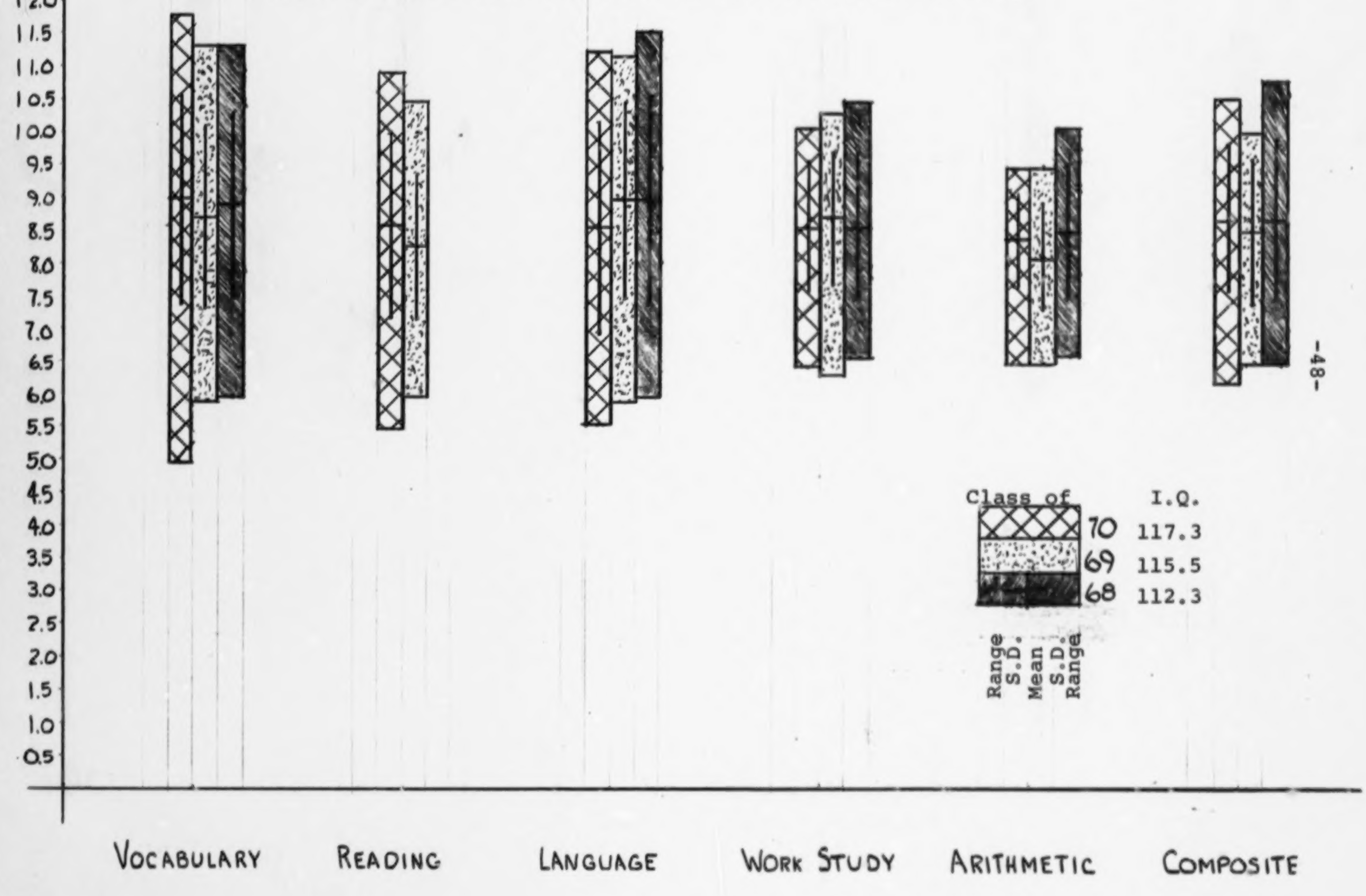
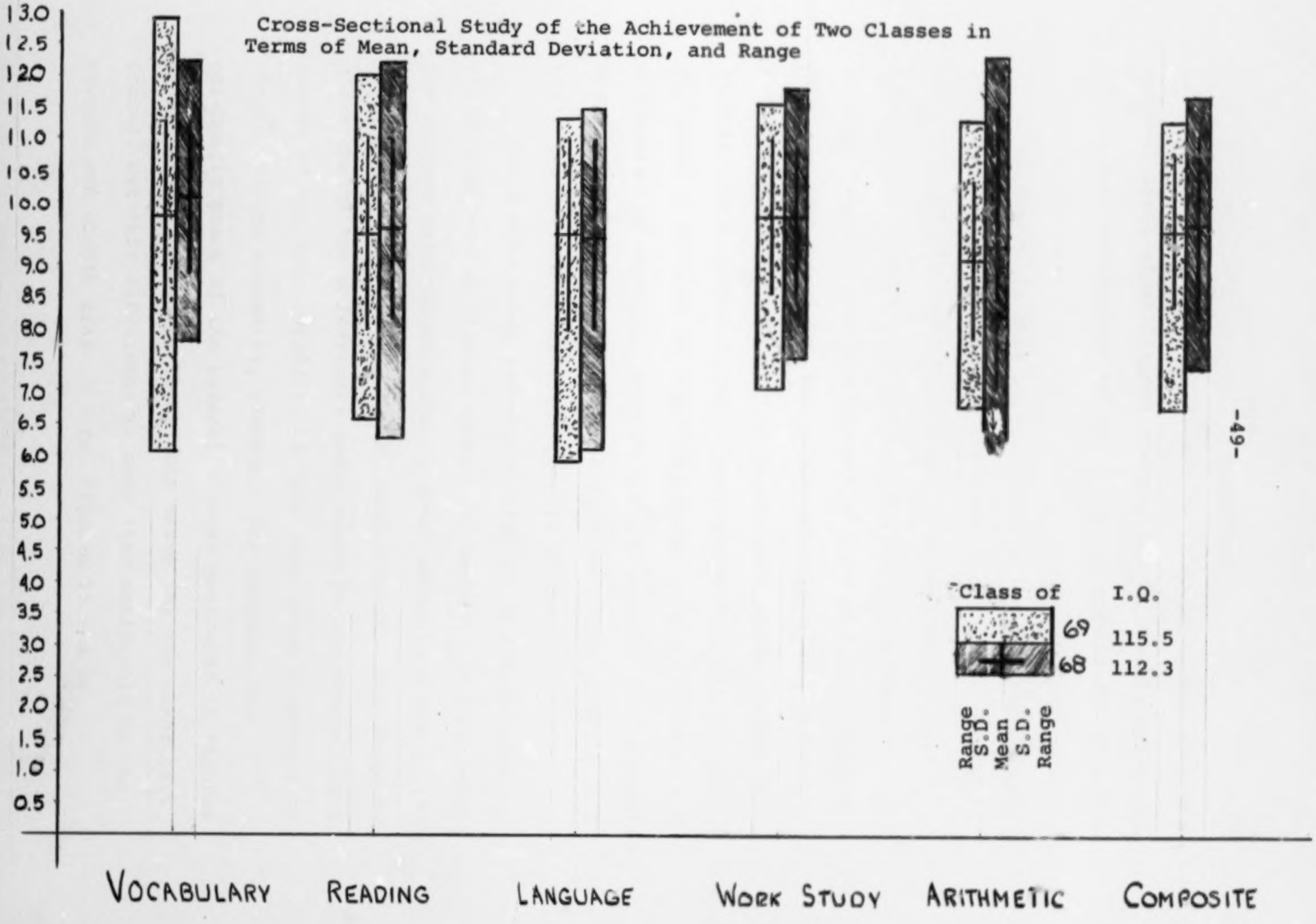


Figure 26

Cross-Sectional Study of the Achievement of Two Classes in Terms of Mean, Standard Deviation, and Range



On Figures 22, 23, 24, and 26 it would appear that the general level of ability of the classes is closely reflected in the mean achievement of the groups of pupils for whom data has been charted.

On Figure 21 this relationship is not clearly portrayed particularly in the case of the class of 1972 for whom the mean I.Q. of 114, next to highest in this group of four classes, is coupled with the lowest mean achievement. It will be recalled that the classes of 1972 and 1973, grades four and five, were the two groups exhibiting the lowest absolute achievement in terms of national norms, Figure 3. In this cross-sectional comparison, grade five clearly out performed grade four at the third grade level. Although the difference in mean I.Q. between the two classes is negligible, the standard deviation of I.Q. scores for grade five is 11.5 while the deviation for grade four is 20.2.

For grades seven and eight, Figures 25 and 26, the difference between classes appears to narrow. In this school the classes were taught within a departmentalized design in which a different teacher taught each subject. For these two class charts the differences among means on the several part scores of the test appear to be less than those displayed on charts for the elementary classes. For example, the arithmetic means of the several classes portrayed in Figures 23 and 24 are noticably lower than means for the other part scores, but this difference is much less noticeable on the seventh and eighth grade charts, Figures 25 and 26.

In terms of changes in teaching assignments at the grade levels charted, there is no basis for suspecting differential results in class achievement. The variations described appear to be generally accounted for by differences in I.Q. or by the standard deviation of I.Q. scores.

Descriptive Analysis of the Secondary School Population

Since the amount of usable longitudinal data available in the school files was less than had been hoped, data from two years of additional testing in the upper four grades employing a variety of measuring instruments were recorded and analyzed to permit the future development of longitudinal graphs of stability and change. It was believed that a study of the interrelationships among the variable factors measured would give some clue to the potential usefulness of the measures employed in this particular school.

Comparisons Among Major Variables

In Table 2 the means and standard deviations for the major variables employed are shown by total class group and by sex within class groupings.

The intelligence quotient scores are taken from administrations of the Lorge-Thorndike Test. Socio-economic ranking was developed on the basis of an eleven point scale based on the United States Department of Commerce classification of persons employed during 1950-60. On this scale the highest ranking occupations, professional and technical workers, were classified as 1 while laborers were classified as 11. The

Table 2

TABLE OF MEANS AND STANDARD DEVIATIONS BY TOTAL CLASS AND BY SEX WITHIN CLASS FOR SELECTED VARIABLES

		N	Mean	S.D.	N.	Mean	S.D.	N.	Mean	S.D.
Class	Variable	Class	Class	Class	M	Males	Males	F	Females	Females
Gr. 12	IQ Verbal	85	121.4	14.8	41	122.3	14.0	44	120.7	15.4
	So. Ec. R.	85	2.6	2.0	41	2.5	2.1	44	2.6	1.9
Class	Creativity	85	296.3	90.4	41	282.1	91.1	44	309.5	87.3
of	Dogmatism	85	150.9	25.1	41	145.0	28.4	44	156.4	20.0
1965	Anxiety	85	31.9	8.2	41	32.7	9.8	44	31.2	6.2
	Comp. Ach.	85	22.0	5.9	41	22.9	5.6	44	21.3	6.1
	GPA	85	2.6	.7	41	2.4	.7	44	2.8	.7
Gr. 11	IQ Verbal	78	121.3	15.0	44	121.8	14.2	34	120.6	16.0
	So. Ec. R.	78	2.7	1.8	44	2.8	1.9	34	2.5	1.9
Class	Creativity	78	280.7	80.9	44	276.7	79.6	34	285.8	80.2
of	Dogmatism	78	156.8	20.9	44	154.4	20.9	34	160.0	20.4
1966	Anxiety	78	17.0	6.1	44	15.5	5.6	34	18.9	6.2
	No-Ver. IQ	78	119.1	11.1	44	119.2	11.0	34	118.7	11.3
	Comp. Ach.	78	23.1	5.6	44	23.3	5.8	34	22.9	5.5
	Motivation	78	103.8	15.4	44	105.5	13.8	34	101.5	17.0
	GPA	78	2.6	.8	44	2.5	.7	34	2.9	.7
Gr. 10	IQ Verbal	64	118.5	12.8	36	118.7	13.3	28	118.3	12.2
	So. Ec. R.	64	2.4	1.8	36	2.4	1.8	28	2.5	1.8
Class	Creativity	64	272.6	74.7	36	266.9	69.8	28	279.9	79.9
of	Dogmatism	64	168.0	25.1	36	171.3	24.7	28	163.6	25.1
1967	Anxiety	64	33.2	7.3	36	33.6	7.0	28	32.6	7.8
	Comp. Ach.	64	18.0	5.2	36	18.0	5.6	28	18.0	4.7
	GPA	64	2.5	.8	36	2.3	.8	28	2.8	.8
Gr. 9	IQ Verbal	69	120.2	13.5	28	121.1	13.4	41	119.5	13.4
	Soc. Ec. R.	69	2.7	2.0	28	2.7	3.1	41	2.8	2.0
Class	Creativity	69	280.1	82.7	28	266.6	77.4	41	289.3	85.0
of	Dogmatism	69	154.8	24.4	28	155.2	55.0	41	154.5	20.3
1968	Anxiety	69	15.9	6.2	28	14.6	5.4	41	16.8	6.5
	No-Ver. IQ	69	121.4	12.3	28	125.0	10.2	41	118.9	13.0
	Comp. Ach.	69	18.2	5.4	28	18.7	4.9	41	17.9	5.7
	Motivation	69	95.5	18.1	28	98.6	18.0	41	93.5	18.2
	GPA	69	2.5	.9	28	2.4	.9	41	2.6	.9

composite score on the Minnesota Creativity Battery was listed as was a dogmatism score resulting from administrations of the Rokeach Dogmatism Test. The Taylor Manifest Anxiety Scale yielded a measure of anxiety and composite achievement as measured by the Iowa Test of Educational Development are included in the scale. Cumulative grade point average calculated for each class completed the list of variables included.

From an inspection of the table it seems clear that the four classes are quite homogeneous with respect to verbal I.Q. Means vary between 121.8 for eleventh grade males and 118.3 for tenth grade females.

The socio-economic ranking indicates that the male parents of pupils are generally employed in professional, managerial or clerical kinds of work.

Girls in this school, on the average, score slightly higher on the creativity scale, and except for grade twelve, the variability of their scores is greater for those obtained from female pupils.

Scores obtained from the dogmatism test do not show much variability among classes included in the table nor do variations between these scores by sex show any constant pattern.

The anxiety scores are almost twice as high for pupils in grades ten and twelve as they are for the other two classes. The data for grades ten and twelve on this variable were gathered in early 1964 some six months after the top administration of the school had been changed. It is possible that changes made by the new administration affecting pupils in the school produced the high anxiety means that were not evident a year later when the other two classes completed the inventory.

It is interesting to note that composite achievement scores for grade ten are almost indentical with those compiled for grade nine. Differences in I.Q. do not seem great enough to explain this lack of difference. Since achievement for grade twelve was tested in 1963 when that group of pupils was in the eleventh grade, these scores are roughly comparable. The only variable for grade ten that is distinctly different is the dogmatism measure. In addition the standard deviation of composite achievement scores is smaller for this group of pupils than for the other three groups.

Finally it will be noted that the grade point average is higher for girls than for boys in each of the four classes while the means on composite achievement for boys are either equal to or slightly higher than comparable scores for girls in the four classes.

An Analysis of Sub-Groups Whose Scores Were One Standard Deviation Above or Below Group Means

In order to further explore the relationships among the variables employed in this part of the study, it was decided to compare the scores of groups lying at the extremes of the ranges of scores on creativity, dogmatism, and anxiety with other selected variables. These data are displayed in Table 3.

Table 3

TABLE OF MEANS FOR CLASSES AND FOR GROUPS WITHIN CLASSES WHOSE SCORES FELL ONE STANDARD DEVIATION ABOVE OR BELOW THE CLASS MEAN BY CLASS AND BY SELECTED VARIABLE

					Mean for Each Group			
Class	Group	N	Lorge-Thorndike Verbal IQ	Socio-Economic Rating	Minnesota Creativity	Rokeach Dogmatism	Taylor Anxiety	ITED Composite
Gr. 12	Class	88	121.89	2.58	297.37	151.07	32.10	22.22
	Lo. Creat.	12	123.58	2.75	171.25	142.33	36.50	23.16
Class	Hi. Creat.	10	123.60	2.10	461.60	147.50	31.60	22.30
of	Lo. Dogmat.	9	127.78	2.78	300.00	113.33	34.78	24.33
1965**	Hi. Dogmat.	10	117.10	2.93	285.10	187.60	29.30	20.00
	Lo. Anx.	9	117.00	2.67	298.78	157.22	18.11	21.33
	Hi. Anx.	17	120.88	2.41	246.94	148.59	42.53	21.88
Gr. 11	Class	81	120.90	2.62	282.65	157.52	17.85	22.67*
	Lo. Creat.	12	114.92	2.42	176.83	159.25	20.67	20.16
Class	Hi. Creat.	15	122.87	2.33	403.93	168.93	20.07	23.53
of	Lo. Dogmat.	16	131.44	2.25	280.81	127.12	15.31	27.81
1966***	Hi. Dogmat.	12	120.83	2.08	311.83	188.08	18.33	21.25
	Lo. Anx.	15	118.49	2.93	264.07	150.07	9.60	22.20
	Hi. Anx.	14	117.07	2.57	296.00	159.21	29.00	21.14
Gr. 10	Class	61	118.28	2.48	270.38	168.46	33.38	20.88
	Lo. Creat.	10	120.30	3.40	169.20	162.40	37.20	21.20
Class	Hi. Creat.	10	118.90	1.80	404.20	171.30	30.60	21.10
of	Lo. Dogmat.	6	123.17	3.17	279.33	121.33	38.00	22.83
1967**	Hi. Dogmat.	8	111.50	2.12	288.51	207.00	30.12	18.25
	Lo. Anx.	12	115.00	2.50	300.50	173.50	22.67	19.42
	Hi. Anx.	11	120.54	3.00	262.27	140.27	44.09	20.91
Gr. 9	Class	68	119.48	2.78	278.79	154.18	15.74	17.81
	Lo. Creat.	9	113.89	3.33	162.50	145.67	12.56	14.44
Class	Hi. Creat.	9	120.44	3.44	432.00	149.78	16.00	20.00
of	Lo. Dogmat.	14	124.78	2.71	302.50	119.00	12.14	20.07
1968***	Hi. Dogmat.	8	115.75	2.25	288.00	190.75	18.75	16.50
	Lo. Anx.	11	123.45	3.09	248.00	138.27	8.18	19.36
	Hi. Anx.	10	118.70	2.90	278.20	169.50	26.40	17.50

* N=78 for Achievement Only
** Data Collected Fall '63
*** Data Collected Fall '64

It is apparent, first of all, that groups at the extremes of the range of creativity scores do not differ consistantly in terms of measured intelligence. For two classes, the high creativity groups have a slightly greater I.Q. mean; while for one class the low creativity group has the highest mean I.Q. I.Q.'s for grade twelve are approximately equal.

The high and low dogmatism groups show a different picture. For all four classes, I.Q. means are higher for the low dogmatism groups.

Again the high and low groups on the anxiety measure exhibit no constant relationship to measured intelligence.

In terms of socio-economic ranking, scores for all classes except for grade nine indicate that children with the higher socio-economic ranking (lower absolute score) tend to have higher creativity rankings at the extreme ends of the range.

Except for grade twelve,groups at the extreme upper level of the range of scores on dogmatism appear to have a slightly higher socio-economic ranking.

Except for grade ten, groups at the extreme upper level of the anxiety scores tend to have higher socio-economic rankings.

There appears to be no consistent relationship between dogmatism and creativity among the extreme groups by class nor is there any evidence of a consistent relationship between measured anxiety of groups at the extremes of the range and creativity scores for the same groups.

None of the variables charted in the table appear to be related to achievement except for dogmatism. In this instance the groups with the highest dogmatism scores do have lower composite achievement scores for all classes tested.

In order to check the tendencies observed in Table 2 more closely, medians were calculated for all four classes in terms of their scores on creativity, dogmatism, anxiety, I.Q., and composite achievement. The six groups of pupils whose scores fell one standard deviation above or below the class mean on creativity, dogmatism, and anxiety were then examined to find the porportion of their scores that fell above or below the class median for four other variables. Chi square tests of significance were applied to these data and the results are displayed in Tables 4, 5, 6, 7, 8, and 9.

On the basis of these tests, none of the proportions of scores reached significance except those for the high and low dogmatism group and the high anxiety group. High dogmatism was significantly **associated with high** achievement for grades nine and eleven, and with high anxiety for grades nine and twelve, Table 3. Similarly low dogmatism was associated with high I.Q. for grade eleven. Strangely enough high dogmatism was associated with high anxiety in Table 4 for grade ten. This finding was consistant when high anxiety pupils in the same grade were tested for the relationship of their dogmatism scores to the class median on this variable, Table 6. No consistent pattern of

Table 4

Number of Scores Above Class Median on Measures of I.Q., Creativity, Anxiety and Composite Achievement for Those Pupils Whose Dogmatism Score Falls One Standard Deviation Below the Class Mean

Class	IQ Above Cl. Median			Creativity Above Cl. Median			Anxiety Above Cl. Median			Achievement Above Cl. Median		
	N	Observd Freq.	Chi-square	N	Observd Freq.	Chi-square	N	Observd Freq.	Chi-square	N	Observd Freq.	Chi-square
65	9	7	0.11	9	6	1.00	9	8	5.44*	9	5	0.11
66	16	12	4.00*	16	8	0	16	5	2.25	16	15	12.25**
67	6	3	0	6	3	0	6	4	0.66	6	4	0.66
68	14	9	1.14	14	10	2.57	14	3	4.57*	14	11	4.57*

All Chi-square values have one degree of freedom.
All observed frequencies are the number observed which were ≥ Median.
*Significant at .05
**Significant at .01

Table 5

Number of Scores Above Class Median on Measures of I.Q., Creativity, Anxiety and Composite Achievement for Those Pupils Whose Dogmatism Score Falls One Standard Deviation Above the Class Mean

Class	I.Q. Above Cl. Median			Creativity Above Cl. Median			Anxiety Above Cl. Median			Achievement Above Cl. Median		
	N	Observd. Freq.	Chi-square	N	Observd Freq.	Chi-square	N	Observd Freq.	Chi-square	N	Observd Freq.	Chi-square
65	10	4	0.40	10	5	0	10	4	0.40	10	3	1.60
66	12	6	0	12	8	1.33	12	8	1.33	12	4	1.33
67	18	2	2.00	8	5	0.50	8	0	8.00**	8	4	0
68	8	2	2.00	8	5	0.50	8	6	2.00	8	3	0.50

All Chi-square values have one degree of freedom.
All observed frequencies are the number observed which were ≥ Median.
*Significant at .05
**Significant at .01

Table 6

Number of Scores Above Class Median on Measures of I.Q., Creativity, and Dogmatism for Those Pupils Whose Anxiety Score Falls One Standard Deviation Below the Class Mean

Class	I.Q. Above Cl. Median			Creativity Above Cl. Mean			Dogmatism Above Class Median			Achievement Above Cl. Median		
	N	Observd Freq.	Chi-square	N	Observd Freq.	Chi-square	N	Observd Freq.	Chi-square	N	Observd freq.	Chi-square
65	9	5	0.11	9	5	0.11	9	5	0.11	9	5	0.11
66	15	6	0.60	15	5	1.66	15	6	0.60	15	7	0.04
67	12	5	0.33	12	8	1.33	12	7	0.33	12	6	0
68	11	7	0.818	11	4	0.818	11	3	2.27	11	7	0.818

All Chi-square values have one degree of freedom.
All observed frequencies are the number observed which were ≥ Median.
*Significant at .05
**Significant at .01

Table 7

Number of Scores Above Class Median on Measures of I.Q., Creativity, Dogmatism and Composite Achievement for Those Pupils Whose Anxiety Score Falls One Standard Deviation Above the Class Mean

Class												
	N	Observd Freq.	Chi-square	N	Observd Freq.	Chi-square	N	Observd Freq.	Chi-square	N	Observd Freq.	Chi-square
65	17	8	0.059	17	6	1.47	17	9	0.059	17	7	0.294
66	14	7	0	14	8	0.286	14	8	0.286	14	8	0.286
67	11	5	0.09	11	6	0.09	11	0	11.00*	11	8	2.27
68	10	4	0.40	10	6	0.40	10	8	3.60	10	5	0

All Chi-square values have one degree of freedom.
All observed frequencies are the number observed which were ≥ Median.
*Significant at .05
**Significant at .01

Table 8

Number of Scores Above Class Median on Measures of I.Q., Dogmatism, Anxiety and Composite Achievement for Those Pupils Whose Creativity Score Falls One Standard Deviation Below the Class Mean

Class	I.Q. Above Cl. Median			Dogmatism Above Cl. Median			Anxiety Above Class Median			Achievement Above Class Median		
	N	Observd Freq.	Chi-square	N	Observd Freq.	Chi-square	N	Observd Freq.	Chi-square	N	Observd Freq.	Chi-square
65	12	6	0	12	4	1.33	12	10	5.33*	12	6	0
66	12	4	1.33	12	8	1.33	12	8	1.33	12	5	0.33
67	10	4	0.40	10	3	1.60	10	7	1.00	10	6	0.40
68	9	3	1.00	9	3	1.00	9	3	1.00	9	3	1.00

All Chi-square values have one degree of freedom.
All observed frequencies are the number observed which were = Median.
*Significant at .05
**Significant at .01

Table 9

Number of Scores Above Class Median on Measures of I.Q., Dogmatism, Anxiety and Composite Achievement for Those Pupils Whose Creativity Score Falls One Standard Deviation Above the Class Mean

Class	I.Q. Above Cl. Median			Dogmatism Above Cl. Median			Anxiety Above Cl. Median			Achievement Above Cl. Median		
	N	Observd Freq.	Chi-square	N	Observd Freq.	Chi-square	N	Observd Freq.	Chi-square	N	Observd Freq.	Chi-square
65	10	7	1.6	10	6	0.4	10	6	0.4	10	6	0.40
66	15	11	3.266	15	11	3.266	15	10	1.66	15	9	0.60
67	10	6	0.40	10	6	0.40	10	4	0.40	10	6	0.40
68	9	5	0.11	9	5	0.11	9	4	0.11	9	7	2.77

All Chi-square values have one degree of freedom.
All observed frequencies are the number observed which were = Median.
*Significant at .05
**Significant at .01

significant relationships were found although it does appear likely that the dogmatism measure is more closely related to achievement than the other measures employed.

Intercorrelations Among Variables Used in the Study

A further examination of the variables employed in the study was pursued through the use of intercorrelation. These data are displayed in Tables 10, 11, 12, and 13.

Again the patterns of relationships are similar to those found in the examination of means and standard deviations of the variables represented.

In general, the relationships between I.Q. and achievement scores are about as one would expect. Socio-economic classification does exhibit some relationship with achievement for grade nine, but these correlations for the remainder of the classes are generally small with the highest correlations appearing between socio-economic classification and correct expression and vocabulary scores.

The lack of relationship between creativity scores and other measures used is quite apparent in these tables. While a slight positive relationship between creativity and achievement scores is found for grade nine (Table 10), for the other classes these correlations are close to zero order.

Again the relationship between low dogmatism and high achievement is found in the inter-correlation tables. In

Table 10

INTERCORRELATIONS BETWEEN SIXTEEN VARIABLES, CLASS OF 1969, UNIVERSITY SCHOOL, N=69

	Soc. Econ. Class	Minn. Creat.	Dogmatism Rokeach	Anxiety, Taylor	Non-Verbal I.Q.	Background Soc. St.	Background Nat. Sci.	Correct. Exp.	Quant. Think.	Reading Soc. St.	Reading Nat. Sci.	Reading Lit.	General Vocab.	Comprehensive Score	Use of Sources
V. I.Q.	457	136	-193	-135	552	762	733	682	668	725	773	806	858	874	460
S.E.C.		006	-053	-169	493	287	331	439	375	259	395	348	387	403	272
M.C.			-002	025	250	295	154	162	-060	198	253	272	326	256	097
Dog.				290	-218	-229	-187	-172	-160	-276	-302	-223	-155	-239	-196
Anx.					-230	-142	-143	-046	-070	-121	-132	-010	-094	-107	-023
N.V. I.Q.						544	639	541	687	507	626	627	543	682	300
B.S.S.							806	618	681	770	838	720	749	903	410
B.N.S.								676	726	704	769	661	696	863	436
C. Ex.									628	524	609	660	699	778	509
Q. Th.										684	631	630	541	796	455
R.S.S.											747	712	742	858	509
R.N.S.												840	780	909	432
R. Lit.													830	875	475
G. Voc.														880	473
Comp.															529

Decimals have been eliminated from Correlation Table.

Table 11

INTERCORRELATIONS BETWEEN FIFTEEN VARIABLES, CLASS OF 1967, UNIVERSITY SCHOOL, N=61

	Soc. Econ. Class	Minn. Creat.	Dogmatism Rokeach	Anxiety Taylor	Backgnd. Soc. St.	Backgnd. Nat. Sci.	Correct. Exp.	Quant. Thinking	Reading Soc. St.	Reading Nat. Sci.	Reading Lit.	General Vocab.	Comprehensive Score	Use of Sources
V. I.Q.	074	093	-245	157	645	679	718	739	746	770	703	795	886	603
S.E.C.		226	077	-116	158	095	112	045	036	-018	193	119	075	100
M.C.			-010	-137	064	-060	085	058	091	062	094	034	055	192
Dog.				-339	-107	-059	-273	-267	-279	-318	-235	-295	-287	-182
Anx.					096	076	072	119	018	142	021	048	114	032
B.S.S.						715	582	661	706	690	674	632	826	677
B.N.S.							482	686	680	756	574	590	783	723
C. Ex.								713	681	655	755	732	815	681
Q. Th.									808	804	617	660	875	707
R.S.S.										794	729	757	906	697
R.N.S.											686	628	877	687
R. Lit.												789	841	675
G. Voc.													848	665
Comp.														783

Decimals have been eliminated from Correlation Table.

Table 12

INTERCORRELATIONS BETWEEN SIXTEEN VARIABLES, CLASS OF 1966, UNIVERSITY SCHOOL, N=78

	Soc. Econ. Class.	Minn. Creat.	Dogmatism Rokeach	Anxiety Taylor	Non-Verbal I.Q.	Backgnd. Soc. St.	Backgnd. Nat. Sci.	Correct. Exp.	Quant. Thinking	Reading Soc. St.	Reading Nat. Sci.	Reading Lit.	General Vocab.	Comprehensive Score	Use of Sources
V. I.Q.	150	194	-311	064	444	728	554	724	699	816	752	736	848	873	786
Soc. E.C.		078	017	111	078	074	-085	210	027	116	158	199	229	129	145
M.C.			129	156	194	128	034	139	174	209	259	196	231	199	145
Dog.				188	-363	-398	-318	-254	-361	-356	-405	-319	-230	-424	-408
Anx.					-105	-004	-127	197	-044	069	049	121	208	058	107
N.V. IQ.						394	372	426	583	479	518	340	283	497	366
B.S.S.							651	558	724	803	715	773	688	875	682
B.N.S.								344	665	540	728	489	457	708	563
C. Ex.									574	704	651	761	776	783	730
Q. Th.										717	722	693	538	827	714
R.S.S.											799	813	776	901	792
R.N.S.												733	706	886	819
R. Lit.													804	881	769
G. Voc.														839	751
Comp.															844

Decimals have been eliminated from Correlation Table.

Table 13

INTERCORRELATIONS BETWEEN FIFTEEN VARIABLES, CLASS OF 1965, UNIVERSITY SCHOOL, N=88

	Socio. Econ. Class	Minn. Creative Thinking	Dogmatism Rokeach	Anxiety Taylor	Backgnd. Soc. Stud.	Backgnd. Nat. Sci.	Correct. Exp.	Quantitative Thinking	Reading Soc. St.	Reading Nat. Sci.	Reading Lit.	General Vocab.	Comprehensive Score	Use of Sources
V. I.Q.	392	013	-208	045	684	667	617	715	723	712	704	851	843	750
S.E.C.		017	031	-064	240	316	377	277	237	238	146	266	324	354
M.C. Th.			079	-058	027	-014	022	-079	103	-017	013	110	005	-000
Dog.				-178	-242	-263	-046	-234	-193	-138	-182	-192	-239	-202
Anx.					030	014	-018	113	-024	006	-047	-002	004	033
B.S.S.						813	385	692	756	724	624	684	854	671
B.N.S.							326	713	728	684	518	634	785	639
C. Ex.								559	529	636	622	618	687	665
Q. Th.									728	756	609	646	855	750
R.S.S.										776	738	744	891	699
R.N.S.											744	719	899	722
R. Lit.												778	836	681
G. Voc.													858	725
Comp.														824

Decimals have been eliminated from Correlation Table.

every single case the correlations are negative with only one case below .10 and three above .40.

Again there is an inconsistency in the relationships between dogmatism and anxiety for two of the classes, nine and eleven yielding positive correlations while for the other two classes, ten and twelve, the relationships were negative. It will be remembered that the levels of anxiety for grades ten and twelve, measured in 1963, were almost twice that of the other two grades measured a year later. Apparently the reduction in anxiety level for grades nine and eleven had the effect of reversing the relationship.

The same reversal of relationship between anxiety and dogmatism is observed among the four classes with scores from grades ten and twelve exhibiting negative correlations in 1964 when anxiety measures were high and positive correlations between grades nine and eleven in 1965 when the anxiety levels were lower.

Relationships between the anxiety measure and the achievement test scores exhibit the same tendency among the four classes although the relationships are not as marked and of a much lower order than those between dogmatism scores and achievement scores.

Intercorrelations Among Selected Variables by Sex

A number of different relationships appear when correlations among selected variables are calculated separately for boys and girls. Tables 14 through 17

Table 14

INTERCORRELATIONS AMONG EIGHT VARIABLES FOR TWENTY-EIGHT MALE AND FORTY-ONE FEMALE NINTH GRADE PUPILS

	Creativity M	Creativity F	Dogmatism M	Dogmatism F	Anxiety M	Anxiety F	Comp. Ach. M	Comp. Ach. F	Motivation M	Motivation F	GPA M	GPA F
V. I.Q., M	.175		-.229		-.150		.829		.295		.398	
V. I.Q., F		.128		-.167		-.115		.905		.398		.641
Creat. M			.111		.069		.448		.256		.403	
Creat. F				-.101		-.032		.175		.044		.033
Dog. M					.257		-.225		-.085		-.273	
Dog. F						.350		-.269		-.228		-.183
Anx. M							.010		-.334		-.325	
Anx. F								-.148		-.406		-.132
Co. Ac. M									.486		.607	
Co. Ac. F										.515		.774
Mot. M **											.662	
Mot. F **												.553

Table 15

INTERCORRELATIONS AMONG SIX VARIABLES FOR THIRTY-SIX MALE AND TWENTY-EIGHT FEMALE TENTH GRADE PUPILS

	Creativity M	Creativity F	Dogmatism M	Dogmatism F	Anxiety M	Anxiety F	Comp. Ach. M	Comp. Ach. F	GPA M	GPA F
Verbal IQ, M	.054		-.299		.191		.847		.767	
Verbal IQ, F		.170		-.243		.124		.904		.782
Creativity M			.079		-.052		.041		.030	
Creativity F				-.116		-.252		.063		.098
Dogmatism M					-.224		-.353		-.270	
Dogmatism F						-.433		-.346		-.052
Anxiety M							.211		.144	
Anxiety F								-.001		-.036
Comp. Ach. M									.861	
Comp. Ach. F										.775

Data on which this table is based were collected in the fall of 1963.

Table 16

INTERCORRELATIONS AMONG EIGHT VARIABLES FOR FORTY-FOUR MALE AND THIRTY-FOUR FEMALE ELEVENTH GRADE PUPILS

	Creativity M	Creativity F	Dogmatism M	Dogmatism F	Anxiety M	Anxiety F	Motivation M	Motivation F	Comp. Ach. M	Comp. Ach. F	GPA M	GPA F
Verb. IQ, M	.269		-.328		.322		.180		.921		.828	
Verb. IQ, F		.114		-.288		-.176		.365		.822		.717
Creat. M			.189		.356		.314		.220		.338	
Creat. F				-.035		-.095		.069		.178		.153
Dog. M					.013		-.269		-.440		-.409	
Dog. F						.334		-.089		-.401		-.158
Anx. M							-.133		.290		.224	
Anx. F								.049		-.198		-.289
Motivation M *									.257		.446	
Motivation F *										.400		.567
Comp. Ach. M											.835	
Comp. Ach. F												.723

*Fahrquar Michigan M. Scale

Data on which this table is based were collected in the fall of 1964.

Table 17

INTERCORRELATIONS AMONG SIX VARIABLES FOR FORTY-ONE MALE AND FORTY-FOUR FEMALE TWELFTH GRADE PUPILS

	Creativity M	Creativity F	Dogmatism M	Dogmatism F	Anxiety M	Anxiety F	Comp. Ach. M	Comp. Ach. F	GPA M	GPA F
Verbal IQ, M	.054		-.299		.191		.847		.767	
Verbal IQ, F		.170		-.243		.124		.904		.782
Creativity M			.079		-.052		.041		.030	
Creativity F				-.116		-.252		.063		.098
Dogmatism M					-.224		-.353		-.270	
Dogmatism F						-.433		-.346		-.052
Anxiety M							.211		.144	
Anxiety F								-.001		-.036
Comp. Ach. M									.861	
Comp. Ach. F										.775

Data on which this table is based were collected in the fall of 1964.

present these data. The additional data on cumulative grade point average were added to these tables as the information became available late in the course of the study.

It will first be noted that correlations between verbal I.Q. and creativity composite scores run slightly higher for boys than for girls. Similarly, the correlation between high I.Q. and low dogmatism is more pronounced for boys than for girls except for grade twelve. Relationships between I.Q. and anxiety are of low order for both sexes except for the correlation of .32 for males in grade eleven.

In all four classes the relationships between I.Q. and composite achievement for both sexes are of higher order than those between I.Q. and cumulative grade point average.

No pattern of relationships appears between creativity and dogmatism scores, and correlations between creativity and anxiety scores display the same lack of pattern.

Relationships between creativity scores and composite achievement scores are all positive, but range from a low of .04 for tenth grade males to .45 for ninth grade males. However, correlations between creativity scores and cumulative grade point average range from a -.54 for twelfth grade males to .40 for ninth grade males. Means and standard deviations of classes by sex give no clue to the wide variations in these correlations.

Again the reversal of relationships between grades twelve and ten, and eleven and nine with respect to dogmatism and anxiety scores is maintained when correlations are run by sex. This time the higher correlations are for girls whether the relationship is positive or negative.

As in the preceding analysis, the correlations between low dogmatism and high achievement are maintained with no appreciable differences between data for boys and girls. However, correlations between dogmatism and grade point average, while exhibiting the same relationship noted between low dogmatism and high achievement, are markedly lower for girls than for boys. Interestingly enough, similar relationships are found between low dogmatism and high motivation with correlations again being much lower for girls.

Motivation as a variable appears to be more closely related to grade point average than to composite achievement for the two classes for which scores were available.

Intercorrelations Among Three Measures of Motivation and Other Selected Variables

Three different measures of motivation, all experimental in nature, were available for use in the study, and it seemed useful to examine the relationships between these three measures and other variables used.

The Michigan State M. Scale developed by William Fahrquar through the use of factor analytic techniques, was one of the measures employed. The other two measures were developed by Jack Frymier at Ohio State University, of which one is a paper and pencil instrument entitled The Junior Index of Motivation. The second instrument is called the Ohio Picture Preference Test and represents an attempt to assess motivation through projective means.

The intercorrelations calculated are shown in Tables 18 and 19.

Both the J.I.M. and M. scales are moderately correlated with verbal and non-verbal I.Q. while correlations between achievement and these two measures range from .32 to .51. However, little relationship is indicated between the Picture Preference Test scores and the I.Q. and achievement measures. The creativity scores again correlate at a very low level with the three motivation measures, the only one of any size being with the J.I.M. scale for pupils in the class of 1968.

Low dogmatism is again seen as having some relationship with high motivation as measured by the M. and J.I.M. scales. This time the greatest degree of relationship is with the J.I.M. scale rather than the M. scale. However, the relationship between low anxiety and the motivation measures is more pronounced between the M. scale and the anxiety measure.

Table 18

INTERCORRELATIONS BETWEEN TEN VARIABLES, CLASS OF 1968, UNIVERSITY SCHOOL, N=69

	Soc. Ed. Class	Minn. Creat.	Dog. Rokeach	Anxiety, Taylor	Non-Verbal IQ	M-Scale	JIM Scale	Picture Preference	Comprehensive Achievement
Verbal IQ	.457	.136	-.193	-.135	.552	.360	.405	.078	.874
Soc. Ec. Class		.006	-.05	-.16	.49	.369	.300	.263	.403
Minn. Creat.			-.002	.025	.250	.105	.258	-.067	.256
Dog. Rokeach				.290	-.218	-.151	-.312	-.002	-.239
Anx. Taylor					-.230	-.393	-.272	-.078	-.107
Non-Verbal IQ						.510	.333	-.026	.682
Michigan State M-Scale							.444	.111	.507
Junior Index Motivation								.356	.437
Ohio Picture Preference Motivation									.008

Table 19

INTERCORRELATIONS BETWEEN TEN VARIABLES, CLASS OF 1966, UNIVERSITY SCHOOL, N=78

	Soc. Ec. Class	Minn. Creat.	Dog. Rokeach	Anxiety, Taylor	Non-Verbal IQ	M-Scale	JIM Scale	Picture Preference	Comprehensive Achievement
Verbal IQ	.150	.194	-.311	.064	.444	.278	.431	.094	.873
Soc. Ec. Class		.078	.017	.111	.078	.040	.092	.060	.129
Minn. Creat.			.129	.156	.194	.184	.125	.044	.199
Dog. Rokeach				.188	-.363	-.112	-.400	.087	-.424
Anx. Taylor					-.105	-.339	-.088	.212	.058
Non-Verbal IQ						.320	.374	.100	.497
Michigan State M-Scale							.569	.129	.324
Junior Index Motivation								.200	.501
Ohio Picture Preference Motivation									.175

Lastly, intercorrelations among the three measures suggest a moderate relationship between the J.I.M. and M. scales and very little relationship between the Picture Preference Scale and the M. scale. Indeed these data reveal no relationships between the Picture Preference Scale and any other measure except the J.I.M. scale which was used as a validation instrument for the development of the projective motivation inventory.

Data Gathered on the School Faculty

Unfortunately insufficient data were gathered on the faculty members of the school to permit the development of any useful comparison of faculty with student groups on the variable measures used. It also turned out that the longitudinal and cross-sectional descriptions and analysis of pupil variables did not point to teacher variability as affecting the measures used with pupils. However, data were collected on three variables for the faculty and are presented in Table 20.

If one refers to Table 2, page 52, it will be noted that the faculty mean creativity score is seven score points above the mean for pupils in grade twelve, the highest mean of the four classes reported in Table 2. The standard deviation of scores for the faculty group is wider than any of the deviations reported for the four classes. As might be expected, ranges of creativity

Table 20

Means, Standard Deviations and Ranges of Scores on Measures of Creativity, Dogmatism, and Anxiety for the University School Faculty, N=42

Measure	Mean	Standard Deviation	Range
Creativity	302.9	96.3	536 - 173
Dogmatism	133.0	27.1	189 - 74
Anxiety	40.2	2.6	48 - 23

* Data collected in the fall of 1964.

scores for pupils are more extreme than those reported for faculty.

As a group, faculty members appear to be considerably less dogmatic than pupil groups, the lowest mean for grade twelve being 150.9. Again for this variable the standard deviation for faculty is wider than for the pupil groups, 27.1 for faculty in comparison with 25.1 for tenth and twelfth grade pupils.

The level of anxiety revealed by faculty scores at the 1964 testing was unusually high. The highest mean score for pupil groups tested at the same time was 33.2 as compared with the faculty mean of 40.2. The lowest score for any of the faculty members was 23 as compared with a mean score of 23.1 for eleventh grade pupils who filled out the inventories in 1964 the following year.

CHAPTER IV

Conclusions and Implications

Conclusions

Based on the analysis of data presented, the following conclusions are advanced:

1. There seems to be little doubt that the data storage system developed as a part of the study is highly practical for the handling of information that may be routinely collected within schools. The system is simple in design, is open ended so that additional variables may be added easily and quickly, and is completely suitable for the collection, storage, and retrieval of information over a long time span.
2. The system as devised lends itself to the generation of a wide range of studies in which the descriptive data already stored on cards may be readily related to new variables of interest. New cards, containing additional information, may be easily added to the data bank. Two studies are already in process that relate new information to the accumulated data. A third study in process is focused on a more complete validation of three experimental instruments used in the present research.

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3. Achievement test data available in the files of the University School were insufficient for the generation of growth indices sufficiently long to reveal the effects of institutional changes that had occurred in the past. The base lines of performance generated do appear to be sensitive to some variable institutional factors in operation. Extension of these base lines in the years ahead may well reveal changes that are attributable to gross institutional change yet to be initiated.
4. Cross-sectional analyses of the achievement of different classes as they pass through a particular grade do reveal variations in performance that are not completely accounted for by differences in the academic aptitude of the several groups. As more data becomes available in succeeding years, it is possible that the sources of such variations can be identified.
5. Of the variables used in the secondary school descriptive analysis, two that appear to have much future usefulness are the Rokeach Dogmatism Scale and the Taylor Manifest Anxiety Scale.

   The Dogmatism Scale appears to have a consistant relationship to achievement as assessed by standardized tests and by teachers' grades. Further, the additional relationship between low dogmatism and motivation as measured by the Fahrquar M Scale appears to confirm the importance of this variable with respect to its relationship with the learning achievement of pupils.

The possible value of the anxiety measure lies in its apparent sensitivity to gross institutional change.

6. The creativity measure appears to be a most useful one to continue in a longitudinal study largely because of its unrelatedness to other variables employed. Little is known at present about the relative stability of this measure over time. No changes were effected in the school during the period studied that would be likely to affect the creativity scores of pupils, and the present base lines laid down should permit the estimation of the results of any efforts on the part of school faculty to enhance the creative abilities of pupils.

7. In general, the analyses made of data collected describe a school that is remarkably stable in terms of the variables selected for study. There is no substantial evidence that change in curriculum or changes in teaching staff and administration have resulted in any change in the measured performance or personality traits of pupils. The results of the analysis also suggest that there is considerable room for constructive change within the school. The achievement growth rates of able and slow pupils appear to be almost identical, and the lack of change in standard deviation of scores further supports the notion that able students are progressing at a rate slower than their capabilities would permit.

Implications

1. The restriction of this study to a single small school raises a host of questions about possible differences in growth characteristics among different school systems. The data collection system and analysis techniques used in this study are simple enough so that they could be set up for a large number of schools and analyzed at a central research agency. It seems reasonable to assume that the differential effects of curriculum and organizational weakness would be revealed through the analysis of the type of growth patterns developed in this study.
2. Many short cuts in the data processing system are possible which would vastly reduce the per pupil cost of such study. If mark-sensing or Digitek scoring procedures were used with the measuring instruments, key punching could be largely eliminated from the process. With a standard card format in use, standard computer programs could generate almost any type of statistical analysis needed.

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Appendix A

Mean, Standard Deviation, and Range of Machine Scored Tests

MEAN, STANDARD DEVIATION, AND RANGE OF MACHINE SCORED TESTS

AUTHOR: Daniel Lott
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PROGRAMMED FOR: David Turney
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Purpose/Description: This program is designed to take scores of several tests and compute the mean, standard deviation, and range. The maxmum number of cards per student is 9, and the maximum number of variables is 99.

Accuracy: All answers are truncated to 4 decimal places.

Machine Configuration: 40K, 1620 w/o TNS, TNF, MF

Program Requirement: 9K

Source Language: SPS

Input: The first card for each student is allowed a maximum of 11 variables. The following cards are allowed a maximum of 11 variables. Each variable is allowed 4 spaces starting with column 1, with 1 blank space separating variables. Variables will be located in columns 1-4, 6-9, 11-14, 16-19, 21-24, 26-29, 31-34, 36-39, 41-44, 46-49, 51-54.

SENSE SWITCH SETTINGS:

MAR-CHECK	STOP
ARITH-CHECK	STOP
I/O CHECK	STOP

Switch 1 on to compute mean, standard deviation, and range for a set of data.

Switch 3 on to average several scores and obtain a composite.

INSTRUCTIONS:

I. Press RESET on console. Place program in reader hopper. Press LOAD.

II. Set sense switches and error switches, then press START and follow instruction.

COMPUTING PASS: M, SD, Range

Header Card

Col. 1	No. of cards per student
2-3	Total no. of variables
4-5	No. of variables on first card
6-7	No. of variables on second card
etc.	

Place Header Card in front of data, then run the program. List output on IBM 407 printer.

AVERAGING PASS:

Col. 1	No. of cards per student
2-3	No. of variables per student
	Maximum of 11 variables allowed

Place Header Card in front of data, then run the program. Output is in the form to be run on the computing pass or listed on IBM 407 printer.

ERROR MESSAGES:

1. Total no. of variables not equal to sum for each card.

   The information on the Header Card is improper. The sum of the no. of variables for each card should equal the total no. of variables.

2. The following no. does not have enough cards.

   Either the cards are out of order or else one card is missing for a student. Remove all cards and start again with corrected set of data.

   If a card is missing for a student, remove all of the cards for that particular student.

   To correct the above errors, resort cards out of order or remove incomplete data. The program resets itself and is ready to start at the beginning. Press START and follow instructions.

```
 BEGIN BLC *&12          ,            ,
       SF  ER1           ,            ,
       BTM CLEAR         ,SUM         ,,CLEAR SUM FIELDS
       BC3 SUMARY        ,            ,
       RCTY              ,            ,
       WATYINS1          ,            ,
       RCTY              ,            ,
       WATYINS2          ,            ,
       RNTYID-1          ,            ,
       RCTY              ,            ,
       SF  ID-1          ,            ,
       BT  TNF           ,*&23        ,
       NOP TITLE&2*80-2  ,ID          ,2
       WACDTITLE         ,            ,
 START RNCDREADP         ,            ,,READ PARAMETER CARD
       TFM VC1           ,0           ,10
       TD  NOC           ,READP       ,,SET NO. OF CARDS/PERSON
       TFM CC            ,0           ,10,CLEAR
       TD  TNOV-1        ,READP&1     ,
       TD  TNOV          ,READP&2     ,
       SF  TNOV-1        ,            ,
B      SF  READP&3       ,            ,2
C      TF  NOV           ,READP&4     ,27
       A   VC1           ,C&11        ,11
       AM  CC            ,1           ,10
       C   CC            ,NOC         ,
       BE  RS1           ,            ,
       AM  B&6           ,2           ,
       SM  C&6           ,2           ,
       AM  C&11          ,2           ,
       B   B             ,            ,
RS1    TFM CC            ,0           ,10
       TFM C&6           ,NOV         ,
       TFM B&6           ,READP&3     ,
       TFM C&11          ,READP&4     ,
       C   VC1           ,TNOV        ,
       BNE ER4           ,            ,
       TFM VC1           ,0           ,10
       BTM CLEAR         ,SUM2        ,,CLEAR SUM SQUARE FIELDS
       BTM CLEAR         ,HISC        ,,CLEAR HI SCORE FIELDS
       TFM ZERO          ,9999        ,8
       BTM CLEAR         ,LOSC        ,,CLEAR LO SCORE FIELDS
       TFM ZERO          ,0           ,7
       CF  ZERO-4        ,            ,
S1     RACDREADD         ,            ,,READ IN DATA CARD
       SF  READD         ,            ,
       BT  TNS           ,*&23        ,,TRANSFER TO STRIP ROUTINE
       NOP DATA&53       ,READD&2*    ,2
                         54-2
       SF  READD&2*75-3  ,            ,
      C   PCODE          ,CODE        ,,COMPARE CODE NO TO PREV
                                        CODE
      BNE HEAD           ,            ,
      TF  PCODE          ,CODE        ,
      AM  CC             ,1           ,10,ADD ONE TO CARD SEQ.
                                       CHECK
      BTM FLAG           ,0           ,10
      BTM A1             ,0           ,10,BRANCH TO OPERATING
                                       ROUTINE
LCAR  C   CC             ,NOC         ,,ARE ALL CARDS FEAD FOR
                                        STUDENT
      BNE S1             ,            ,,NO
      BLC COMPUT         ,            ,,CHECK FOR LAST CARD
      TFM CC             ,0           ,10,CLEAR A CARD COUNTER
COMPUTLD  95             ,SUM         ,7,COMPUTE MEAN
      D   86             ,TS          ,
      SF  88             ,            ,
      BT TNF             ,*&23        ,,TRANSMIT MEAN TO OUTPUT
      NOP OUTPUT&2*20-2  ,95          ,2
      SF  92             ,            ,
      TFM OUTPUT&2*16-2  ,03          ,10,TRANSMIT PERIOD TO
                                       OUTPUT
      BT  TNF            ,*&23        ,
      NOP OUTPUT&2*15-2  ,91          ,2
M3    M   SUM2           ,TS          ,2,COMPUTE N X SUM2
      TF  ANS            ,99          ,
      M   COMPUT&11      ,COMPUT&11,611,COMPUTE SUM X SUM
      SF  86             ,            ,
      S   ANS            ,99          ,
SQROOTTFM TOLER&11       ,TOL         ,
      BD  SQR            ,ANS-13      ,7
      BD  SQR            ,ANS-12      ,7
      AM  *-13           ,2           ,
      AM  *-13           ,2           ,
      SM  TOLER&11       ,7
      CM  *-37           ,ANS
      BNE SQROOT&12      ,            ,
SQR   TFM SQROOT&23      ,ANS-13      ,
      TFM SQROOT&35      ,ANS-12
      TF  79             ,ZERO        ,
      M   XN             ,XN          ,.COMPUTE SQUARE ROOT
      SF  78             ,            ,
      TF  HOLD           ,95          ,
      A   HOLD-4         ,ANS         ,
      MM  XN             ,2           ,
      SF  86             ,            ,
      TF  DEN            ,99          ,
      TF  79             ,ZERO        ,
      TF  70             ,ZERO        ,
      LD  94             ,HOLD
      D   77            ,DEN          ,
      SF  71            ,             ,
      AM  85            ,5            ,
      TF  XN            ,84           ,
      TF  79            ,ZERO
      M   XN            ,XN           ,
      S   95            ,ANS&4
      CF  95
TOLER S   94            ,TOL          ,
      BNF SQR           ,94           ,
      LD  99            ,XN           ,
      D   86            ,TS           ,
      SF  88            ,             ,
      SF  92            ,             ,
      BT  TNF           ,*&23         ,
      NOP OUTPUT&2*35-2 ,91           ,2
      TFM OUTPUT&2*36-2 ,03           ,10
      BT  TNF           ,*&23         ,
      NOP OUTPUT&2*40-2 ,95           ,2
      BT  TNF           ,*&23         ,
O1    NOP OUTPUT&2*55-2 ,HISC         ,2
      TFM OUTPUT&2*56-2 ,03           ,10
      BT  TNF           ,*&23         ,
02    NOP OUTPUT&2*70-2 ,LOSC         ,2
      TFM OUTPUT&2*71-2 ,03           ,10
      SM  COMPUT&11     ,10           ,
      SM  M3&6          ,10           ,
      SM  01&11         ,10           ,
      SM  02&11         ,10           ,
      AM  OUTC          ,1            ,10
      BT  TNF           ,*&23         ,
      NOP  OUTPUT&2*2-2 ,OUTC         ,2
      WACDOUTPUT        ,             ,
      BTM PCLEAR        ,0            ,10
      C   OUTC          ,TNOV         ,
      BNE COMPUT        ,             ,
      BT  TNF           ,*&23         ,
      NOP OUTPUT&2*34-2 ,TS           ,2
      TR  OUTPUT-1      ,OMES-1       ,
      TDM OUTPUT&2*28-2 ,0            ,
      WACDOUTPUT        ,             ,
      BTM PCLEAR        ,0            ,10
WOD   TFM 01&11         ,HISC         ,
      TFM 02&11         ,LOSC         ,
      CF  01&7          ,             ,
      CF  02&7          ,             ,
      TFM COMPUT&11     ,SUM          ,
      TFM M3&6          ,SUM2         ,
      TFM OUTC          ,0            ,10
      TFM TS            ,0            ,8
```

```
        BNF BEGIN           ,ER1        ,
        WATYEINS
        RCTY
        H                   ,           ,
        B   BEGIN           ,           ,
HEAD    CM  CC              ,0          ,10,IS HEADER CARD DUE UP
        BNE ER1             ,           ,
        AM  CC              ,1          ,10
        TFM VCC             ,0          ,10
        TFM VC1,0,10
        TF  PCODE           ,CODE       ,
        AM  TS              ,1          ,8,ADD TO TOTAL STUDENTS
        BTM FLAG            ,0          ,10
        BTM A1              ,           ,
        B   LCAR            ,           ,
FLAG    SF  DATA            ,           ,2,GENERATE FLAGS FOR DATA
        AM  FLAG&6          ,5          ,
        AM  DO              ,1          ,10
        CM  DO              ,11         ,10,GENERATE 11 FLAGS ONLY
        BNE FLAG            ,           ,
        TFM DO              ,0          ,10
        TFM FLAG&6          ,DATA       ,,RESET FLAG GENERATOR
        BB                  ,           ,
A1      A   SUM             ,DATA&3     ,27,ADD VAR TO SUM FIELD
M1      M   A1&11           ,A1&11      ,611,SQUARE VARIABLE
A2      A   SUM2            ,99         ,2,ADD SQUARE TO ACCUM
C1      C   HISC            ,A1&11      ,211,CHECK FOR TOP OF RANGE
        BNL ONW             ,           ,
        TF  C1&6            ,A1&11      ,611,STORE NEW HI SCORE
ONW     C   LOSC            ,A1&11      ,211,CHECK FOR LO SCORE
        BNH ONWA            ,           ,
        TF  ONW&6           ,A1&11      ,611,STORE NEW LO SCORE
ONWA    AM  A1&11           ,5          ,
        AM  VC1             ,1          ,10
        AM  VCC             ,1          ,10,ADD ONE TO VAR CC
AD      SM  A2&6            ,10         ,,SHIFT ADDRESSES
        SM  C1&6            ,10         ,
        SM  ONW&6           ,10         ,
        SM  A1&6            ,10         ,,SHIFT ADDRESSES
DOU     C   VCC             ,TNOV       ,,HAVE ALL VARIABLES BEEN
                                          ADDED
        BE  BACK            ,           ,
FCOM    C   VC1             ,NOV        ,7,ARE ALL VAR ADDED FOR
                                           CARD
        BNE A1              ,           ,
        SM  FCOM&11         ,2          ,
        B   BACK1           ,           ,
BACK    TFM A2&6            ,SUM2       ,
        TFM A1&6            ,SUM        ,
        TFM FCOM&11         ,NOV        ,
       TFM C1&6         ,HISC        ,
       TFM ONW&6        ,LOSC        ,
 BACK1 TFM A1&11        ,DATA&3      ,
       TFM VC1          ,0           ,10
       BNF WOD          ,ER1         ,
       BB               ,
 CLEAR TF  CLEAR-1      ,ZERO        ,6,CLEAR 10 DIGIT FIELD
       AM  J            ,1           ,10
       SM  CLEAR-1      ,10          ,,DROP ADDR BY 10
       CM  J            ,30          ,10,CLEARED ENOUGH FIELDS
       BL  CLEAR        ,            ,
       TFM J            ,0           ,10,RESET COUNTER
       BB               ,            ,
 TNS   SF  TNS-5        ,            ,
       TD  TNS-6        ,TNS-1       ,611,TRANSMIT DIGIT TO NO F
       BNF CON          ,TNS-1       ,11,CHECK FOR FIELD FLAG
       BB               ,            ,
 CON   SM  TNS-1        ,2           ,,LOWER ADDR BY 2 DIGITS
       SM  TNS-6        ,1           ,,LOWER ADDR BY 1 DIGIT
       B   TNS&12       ,            ,
       DS  6
 TNF   SF  TNF-5        ,            ,
       TD  *&23         ,TNF-1       ,11
       TFM TNF-6        ,70          ,610
       BNF CO           ,TNF-1       ,11
       BB               ,            ,
 CO    SM  TNF-1        ,1
       SM  TNF-6        ,2           ,
       B   TNF&12       ,            ,
 PCLEARTFM OUTPUT       ,0           ,2810
       AM  PCLEAR&6     ,2
       AM  PCLEAR&9     ,1           ,10
       CM  PCLEAR&9     ,80          ,10
       BNE PCLEAR
       TFM PCLEAR&6     ,OUTPUT
       TFM PCLEAR&9     ,0           ,10
       BB               ,
 SUMARYWATYA11
       RCTY
       RNCDREADP
       CF  SUMARY       ,            ,
       TFM VCC          ,0           ,10
       TFM VC           ,0           ,10
       TD  VC           ,READP       ,,NO OF CARDS PER PERSON
       TD  VCC-1        ,READP&1     ,,NO OF VARIABLES
       TD  VCC          ,READP&2     ,
       SF  VCC-1        ,            ,
       TF  VAR1         ,VC          ,
 RE    RACDREAL         ,            ,
       SF  READD&2*75-3 ,            ,
      C   PCODE       ,CODE    ,
      BNE COMPAR      ,        ,
      CF  READD&2*75-3 ,       ,
      SF  SUMARY      ,        ,
      SF  READD&2*59-3 ,       ,
      TF  OUTPUT&2*80-2 ,READD&2* ,
                       80-2
      SF  READD&2*75-3 ,       ,
      AM  VAR1        ,1       ,10
      SF  READD       ,        ,
      BT  TNS         ,*&23    ,
      NOP DATA&53     ,READD&2* ,2
                       54-2
      BTM FLAG        ,0       ,10
AUX   A   SUM         ,DATA&3  ,27
      AM  VC1         ,1       ,10
      C   VC1         ,VCC     ,,ALL VARIABLES BEEN ADDED
                                 FOR CARD
      BE NEWC         ,        ,
      SM  AUX&6       ,10      ,
      AM  AUX&11      ,5       ,
      B   AUX         ,        ,
COMPARC   VAR1        ,VC      ,,READ ALL CARDS
      BNE ER2         ,        ,
      TF  PCODE       ,CODE    ,
      TFM VAR1        ,0       ,10,RESET CARD COUNTER
      BNF RE&48       ,SUMARY  ,
AV    LD  97          ,SUM     ,7,COMPUTE AVERAGE FOR EACH
                                  VAR
      D   88          ,VC
      SF  93
      BT  TNF         ,*&23    ,
NOP   NOP OUTPUT&2*4-2 ,96     ,2
      Sm  AV&11       ,10      ,
      AM  NOP&6       ,10      ,
      AM  VC1         ,1       ,10
      C   VC1         ,VCC     ,
      BNE AV          ,        ,
      TFM AV&11       ,SUM     ,
      TFM NOP&6       ,OUTPUT&2 ,
                       *4-2
      BTM CLEAR       ,SUM     ,
      WACDOUTPUT      ,        ,
      BTM PCLEAR      ,0       ,10
      TFM VC1         ,0       ,10
      TFM AUX&6       ,SUM     ,
      TFM AUX&11      ,DATA&3  ,
      BNF RE&48       ,AV      ,
      WATYEINS
      RCTY
      H                 ,         ,
      BNC2BEGIN         ,         ,
      B   RE            ,         ,
NEWC  TFM VC1           ,0        ,10
      CF  AV            ,         ,
      TFM AUX&6         ,SUM      ,
      TFM AUX&11        ,DATA&3   ,
      BLC SFL           ,         ,
      B   RE            ,         ,
SFL   SF  AV            ,         ,
      B   COMPAR        ,         ,
ER1   WATYERR2          ,         ,
      WATYPCODE-10      ,         ,
      RCTY              ,         ,
      CF ER1            ,         ,
      H                 ,         ,
      B   BACK
ER2   WATYERR2          ,         ,
      WATYPCODE-10      ,         ,
      RCTY              ,         ,
      H                 ,         ,
      B   BEGIN         ,         ,
ER4   WATYERR4          ,         ,
      TFM VC1           ,0        ,10
      RCTY              ,         ,
      H                 ,         ,
      B   BEGIN         ,         ,
NOC   DC  2,0
NOV   DS  20
TNOV  DC  2,0
READP DSS 80
SUM   DS  ,20000
SUM2  DS  ,19000
HISC  DS  ,18000
LOSC  DS  ,17000
READD DAS 80
CODE  DS  ,READD&2*80-2
      DAC 1,@
PCODE DC  12,0
      DAC 1,@
CC    DC  2,0
ID    DS  2
DO    DC  2,0
VCC   DC  2,0
VC    DC  2,0
TS    DC  4,0
J     DC  2,0
VC1   DC  2,0
DATA  DSS 80
OUTPUTDAS 80
~~OUTC  DC  2,0~~
```

```
VAR1  DC  2,0
      DC  7,1
      DC  7,10
      DC  7,100
      DC  7,1000
      DC  7,10000
      DC  7,100000
TOL   DC  7,1000000
ANS   DC  14,0
      DSC 4,0
XN    DC  14,1000
      DC  1,@
HOLD  DC  18,0
DEN   DC  14,0
ZERO  DC  10,0
TITLE DAC 30,VAR.      MEAN      ,
      DAC 30,ST.DEV.        HIGH ,
      DAC 20,    LOW       ,
INS1  DAC 33,TYPE IN TWO DIGITS AS IDENT. NO.@
INS2  DAC 25,THEN PUSH RELEASE, START@
ERR2  DAC 45,THE FOLLOWING NO. DOES NOT HAVE ENOUGH CARDS@
ERR4  DAC 48,TOTAL NO. OF VAR NOT EQUAL TO SUM FOR EACH CARD@
OMES  DAC 28,TOTAL NUMBER OF STUDENTS IS@
A11   DAC 32,AVERAGING PASS, READ DATA CARDS@
EINS  DAC 35,END OF JOB, PUSH START FOR NEW DATA@
      DEND402
```

APPENDIX B

Growth Charts Based on California Achievement Test Data, Grades Ten Through Twelve

Figure 27

Growth Charts Based on Mean Scores for Vocabulary on the California Achievement Test, Grades Ten Through Twelve

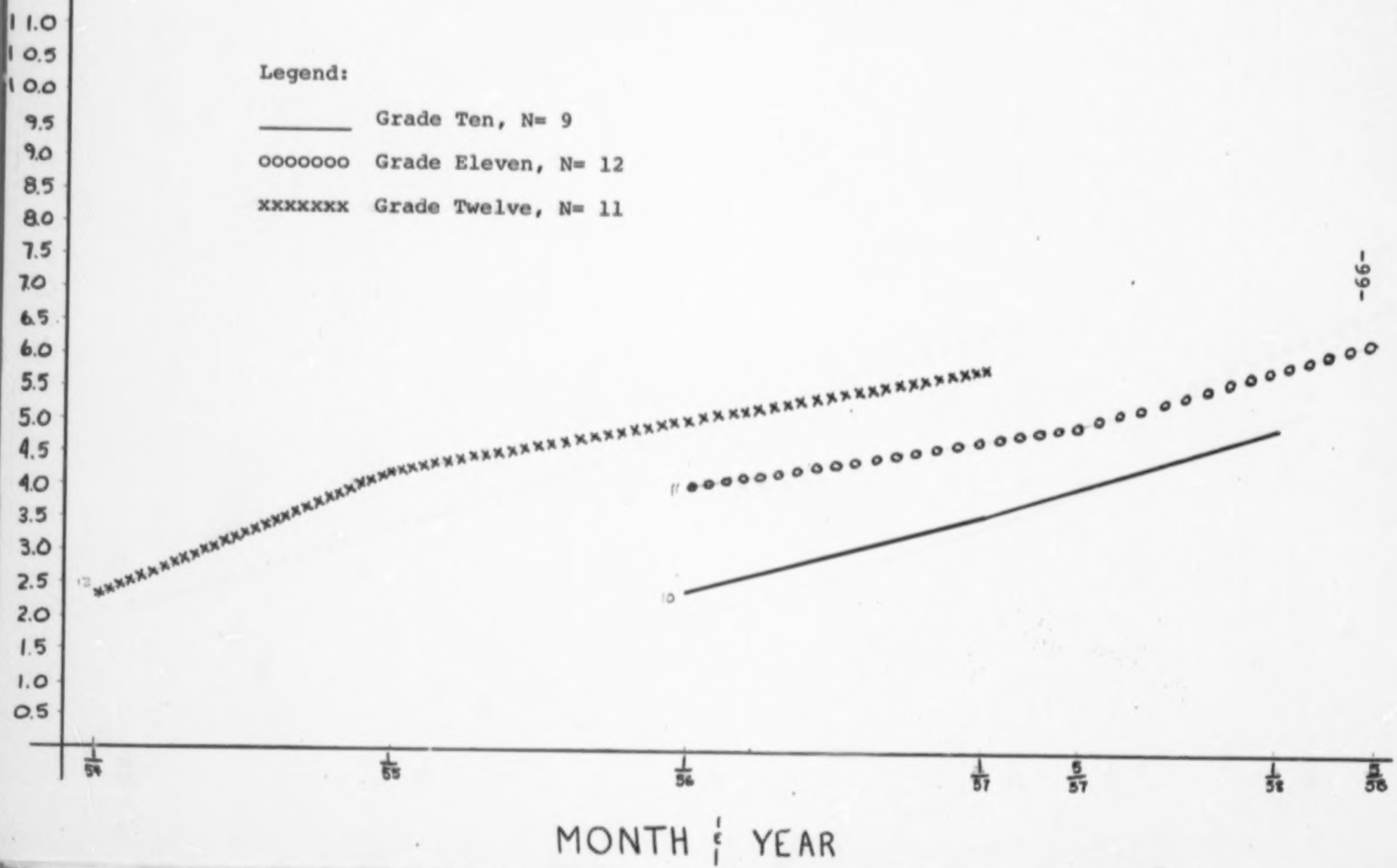


Figure 28

Growth Charts Based on Mean Scores for Reading Comprehension on the California Achievement Test, Grades Ten Through Twelve

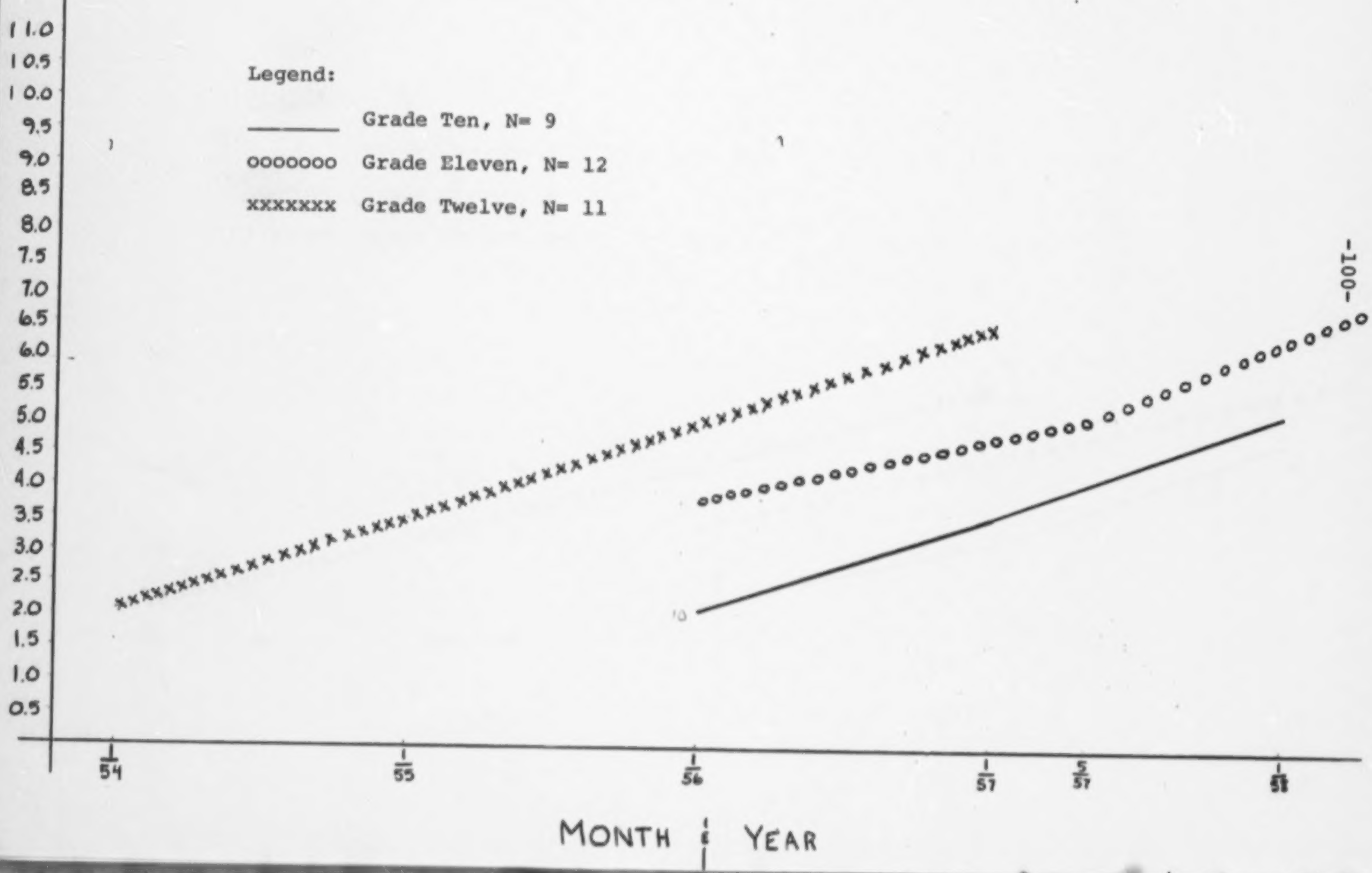


Figure 29

Growth Charts Based on Mean Scores for Arithmetic Reasoning on the California Achievement Test, Grades Ten Through Twelve

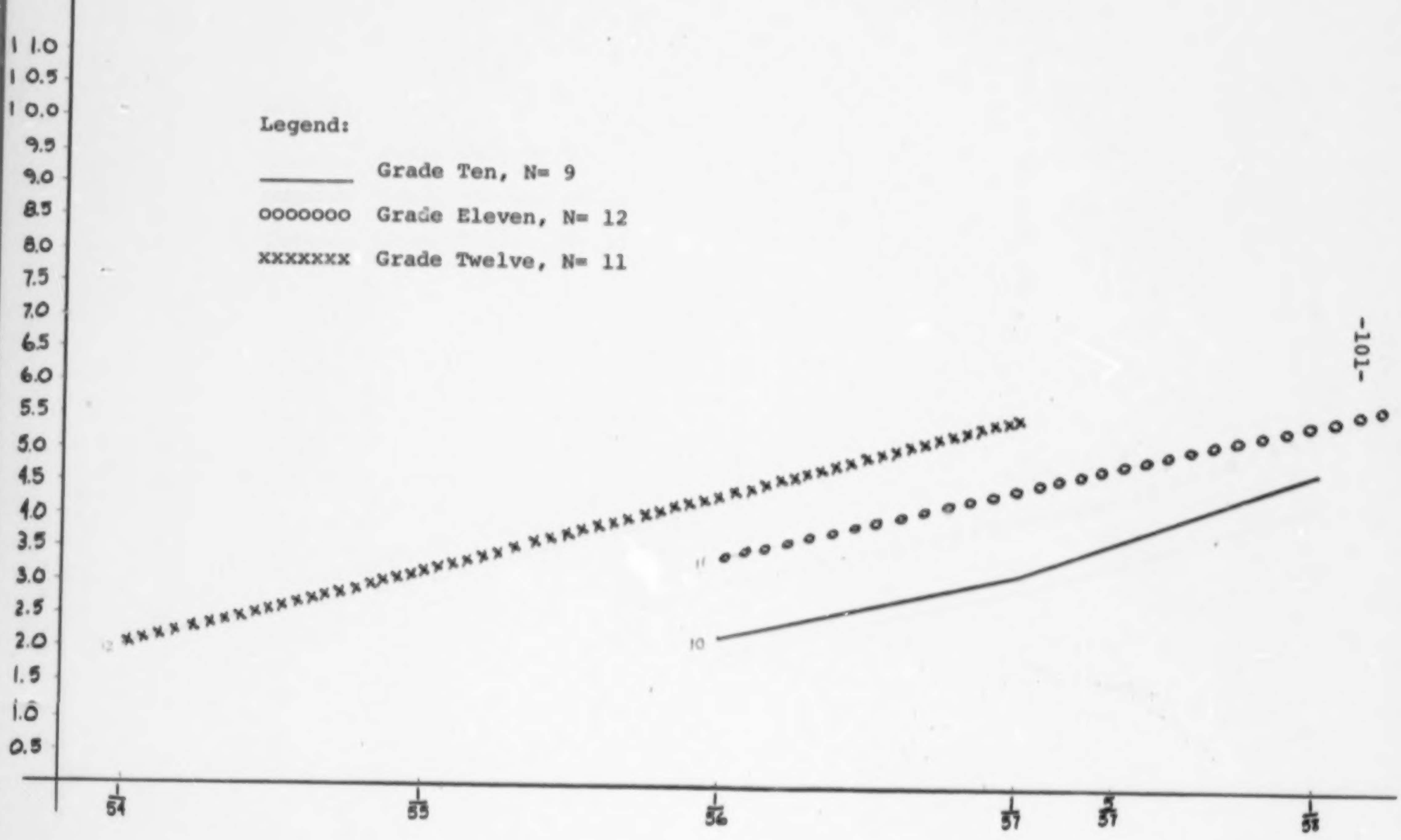


Figure 30

Growth Charts Based on Mean Scores in Arithmetic Fundamentals on the California Achievement Test, Grades Ten Through Twelve

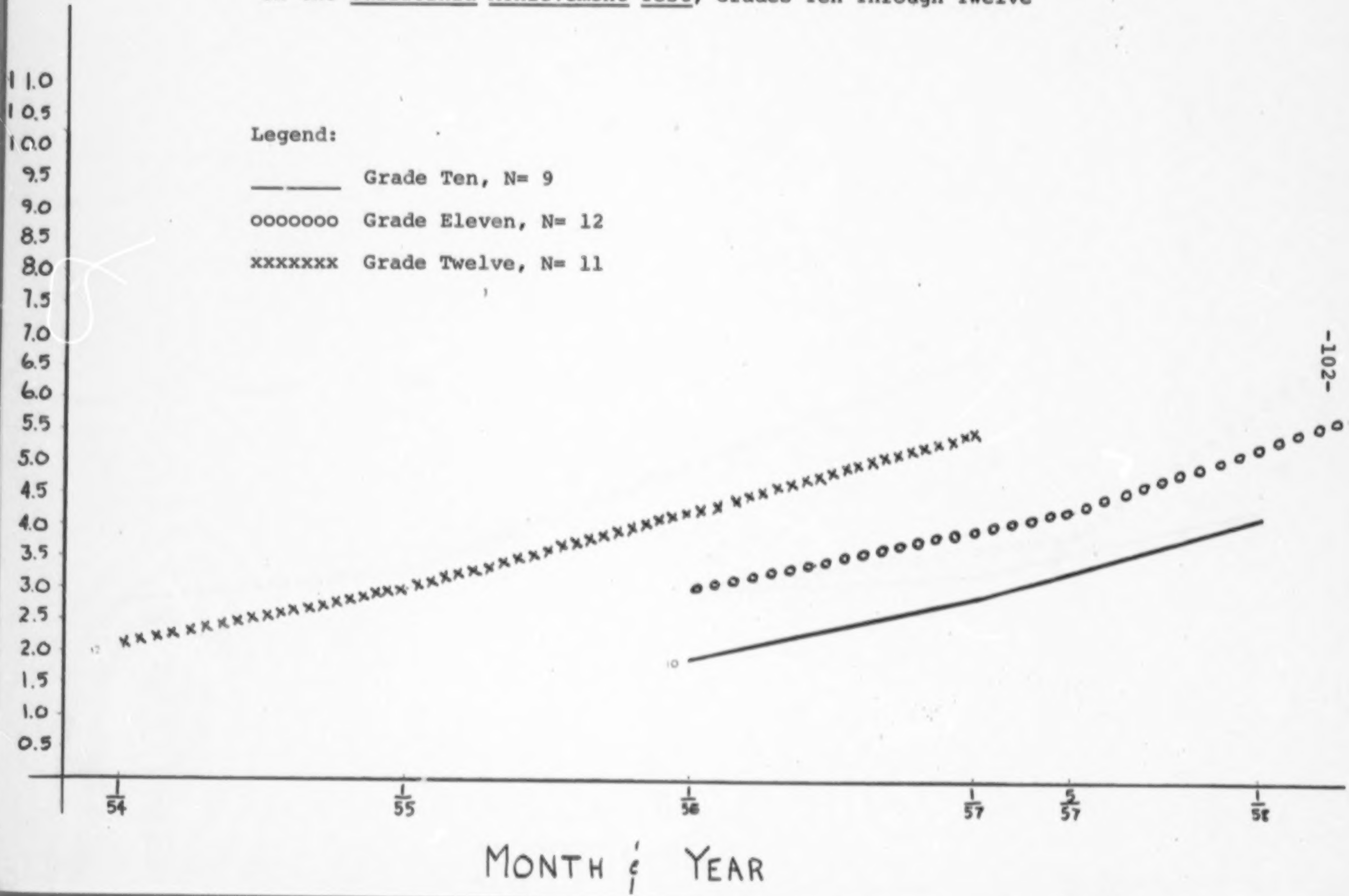


Figure 31

Growth Charts Based on Mean Scores for Language Mechanics on the *California Achievement Test*, Grades Ten Through Twelve

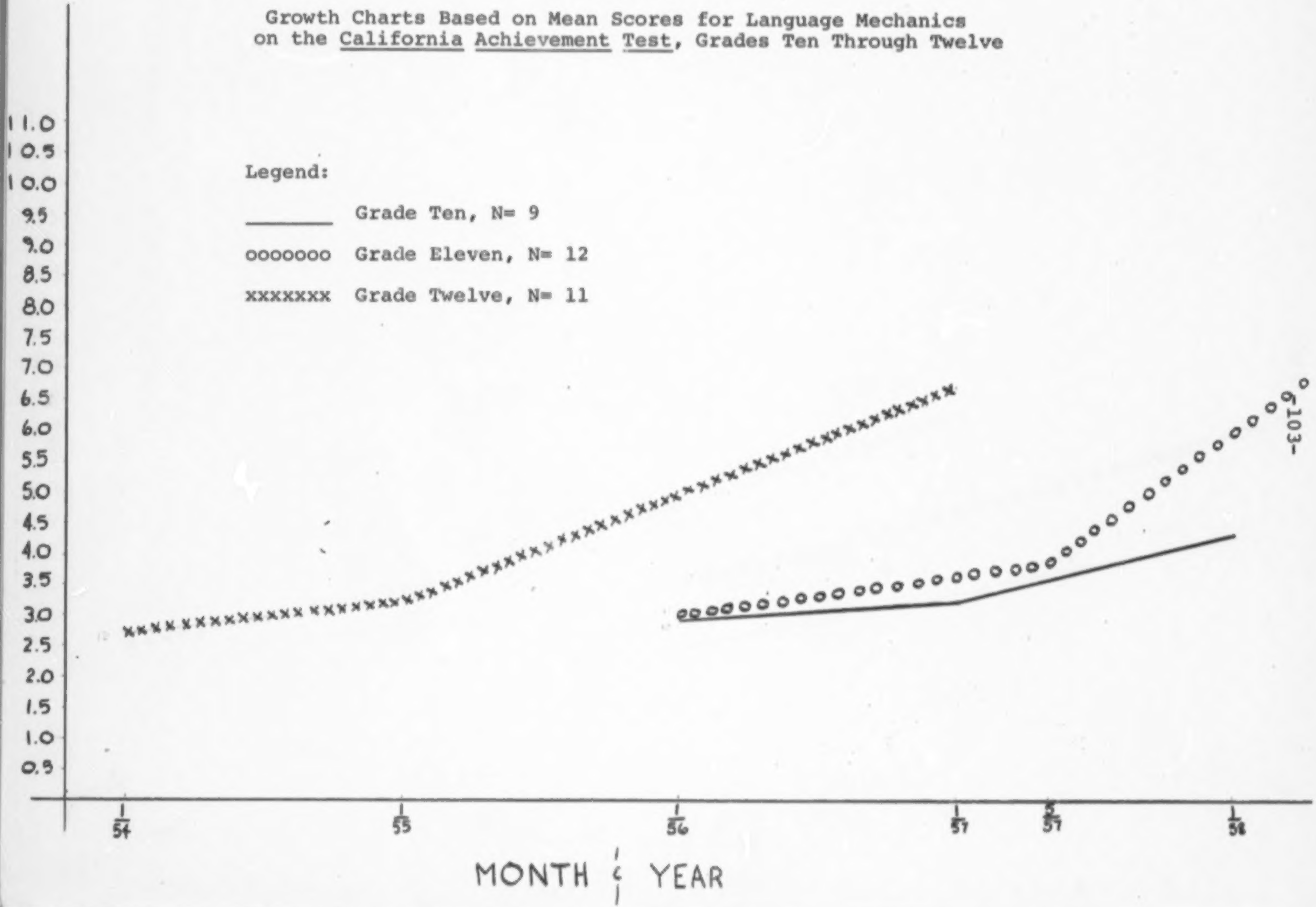
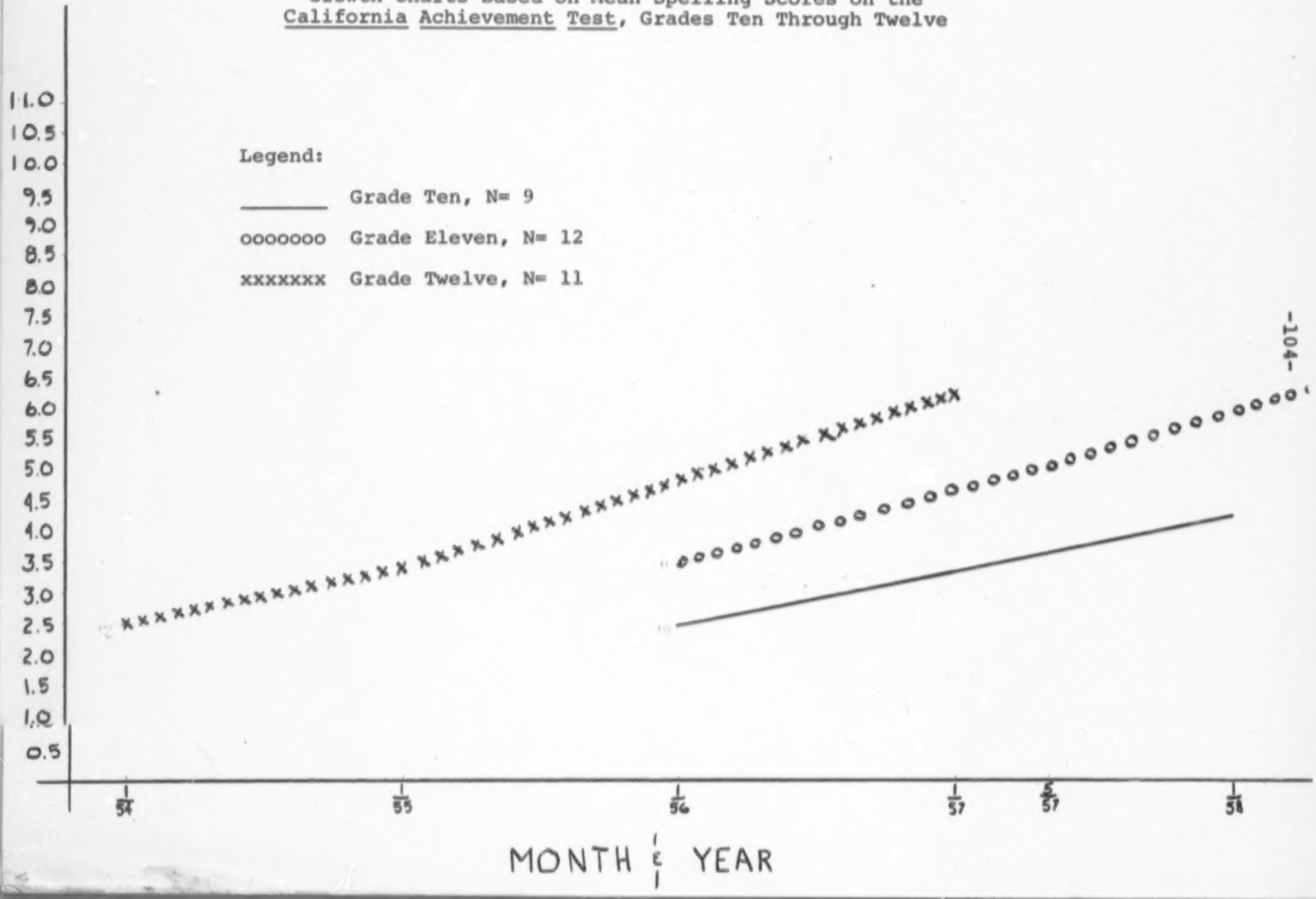


Figure 32

Growth Charts Based on Mean Spelling Scores on the *California Achievement Test*, Grades Ten Through Twelve



APPENDIX C

Longitudinal Representation of Growth in Achievement in Terms of the Iowa Test of Basic Skills Grades Four Through Six and Grades Eight Through Twelve

Figure 33

Longitudinal Representation of Composite Growth in Achievement for Grade Four in Terms of Mean, Standard Deviation and Range, Iowa Test of Basic Skills

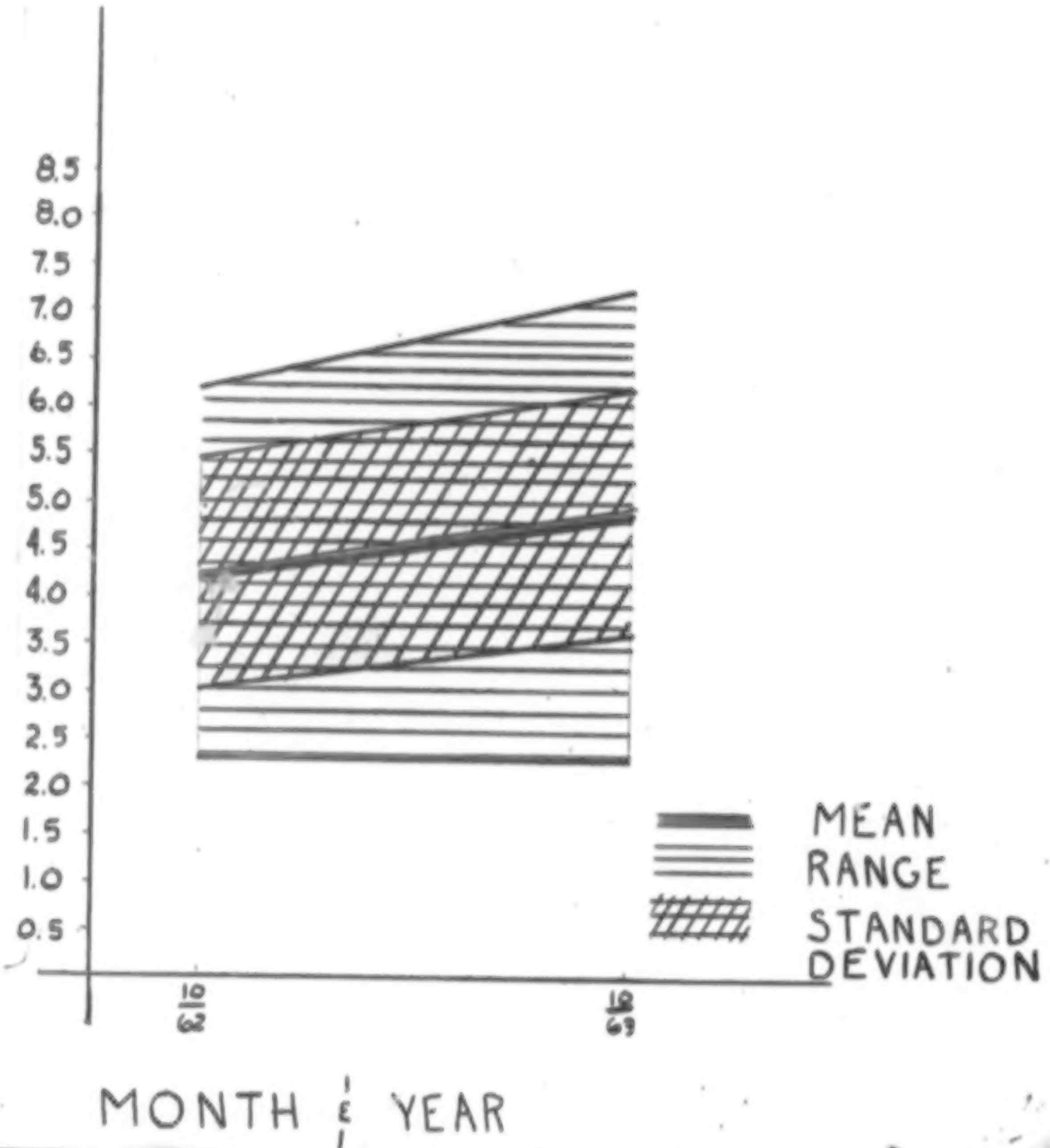
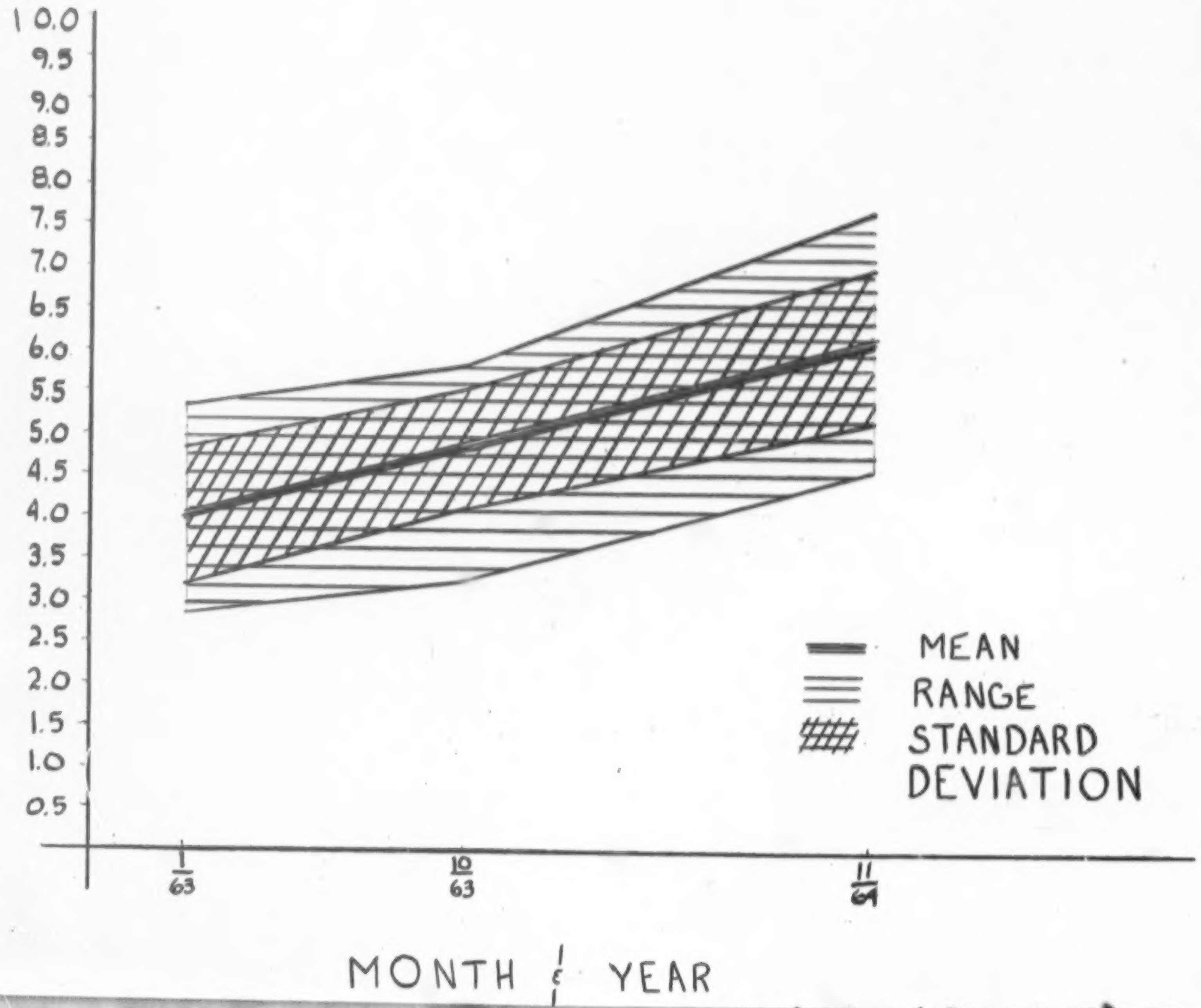


Figure 34

Longitudinal Representation of Composite Growth in Achievement for Grade Five in Terms of Mean, Standard Deviation and Range, Iowa Test of Basic Skills



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1.0
4.5
5.0
5.6
6.3
2.8
3.2
3.6
4.0
2.5
2.2
2.0
1.1
1.8
1.25
1.4
1.6

MICROCOPY RESOLUTION TEST CHART
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Figure 35

Longitudinal Representation of Composite Growth in Achievement for Grade Six in Terms of Mean, Standard Deviation and Range, Iowa Test of Basic Skills

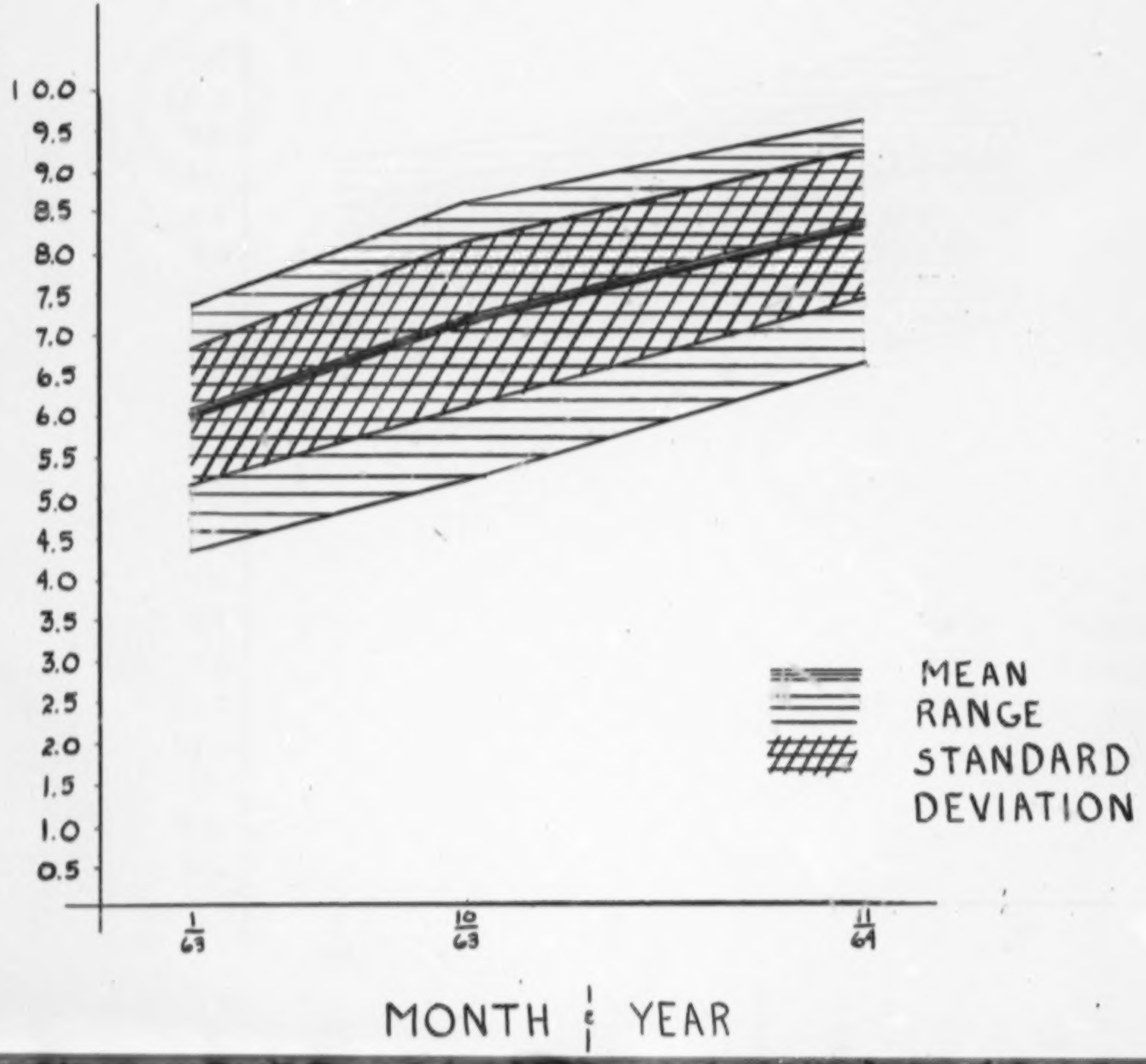


Figure 36

Longitudinal Representation of Composite Growth in Achievement for Grade Eight in Terms of Mean, Standard Deviation and Range, Iowa Test of Basic Skills

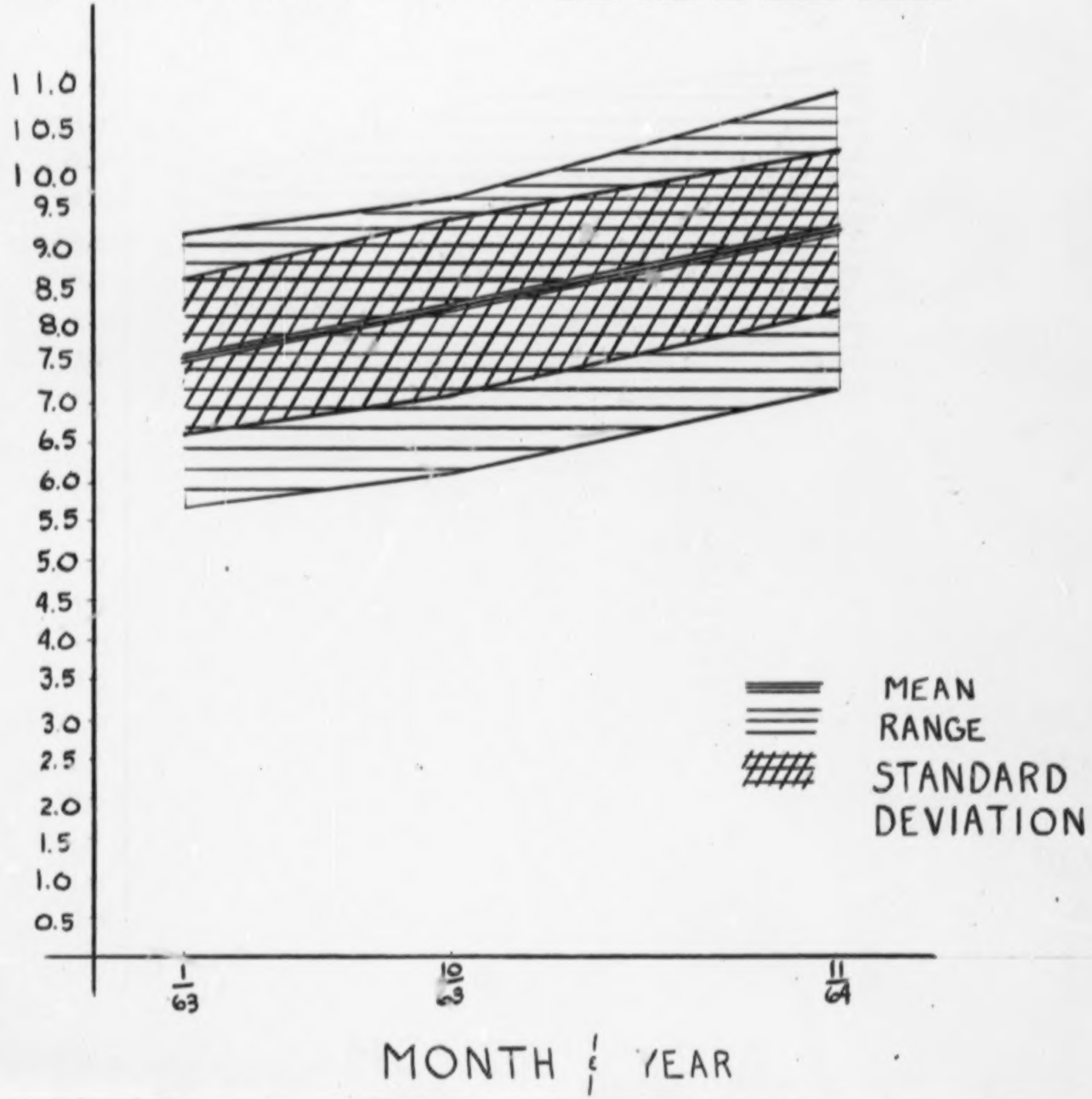


Figure 37

Longitudinal Representation of Composite Growth in Achievement for Grade Nine in Terms of Mean, Standard Deviation and Range, _Iowa_ _Test_ _of_ _Basic_ _Skills_

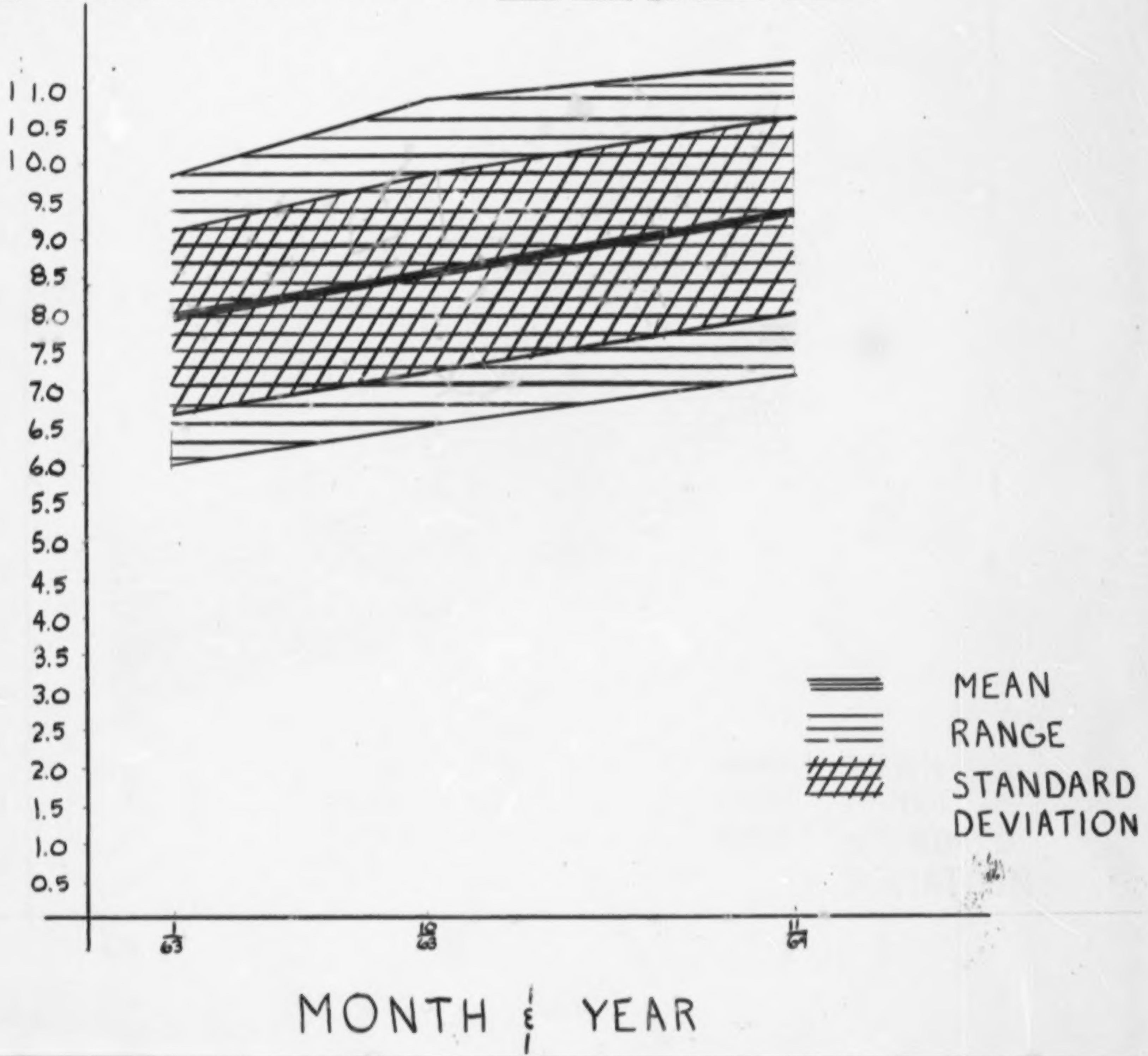


Figure 38

Longitudinal Representation of Composite Growth in Achievement for Grade Ten in Terms of Mean, Standard Deviation and Range, California Achievement Tests

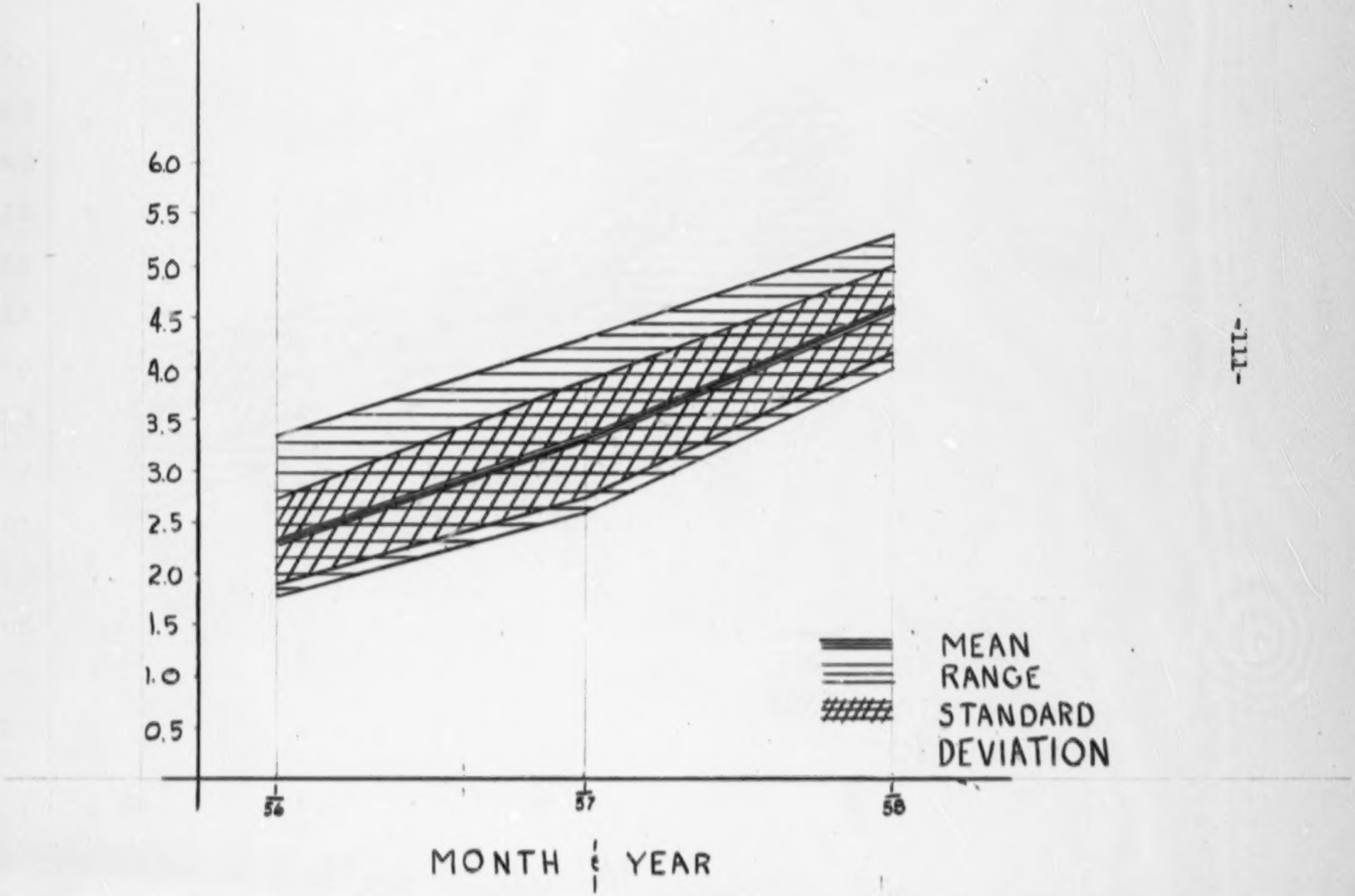


Figure 39

Longitudinal Representation of Composite Growth in Achievement for Grade Eleven in Terms of Mean, Standard Deviation and Range, California Achievement Tests

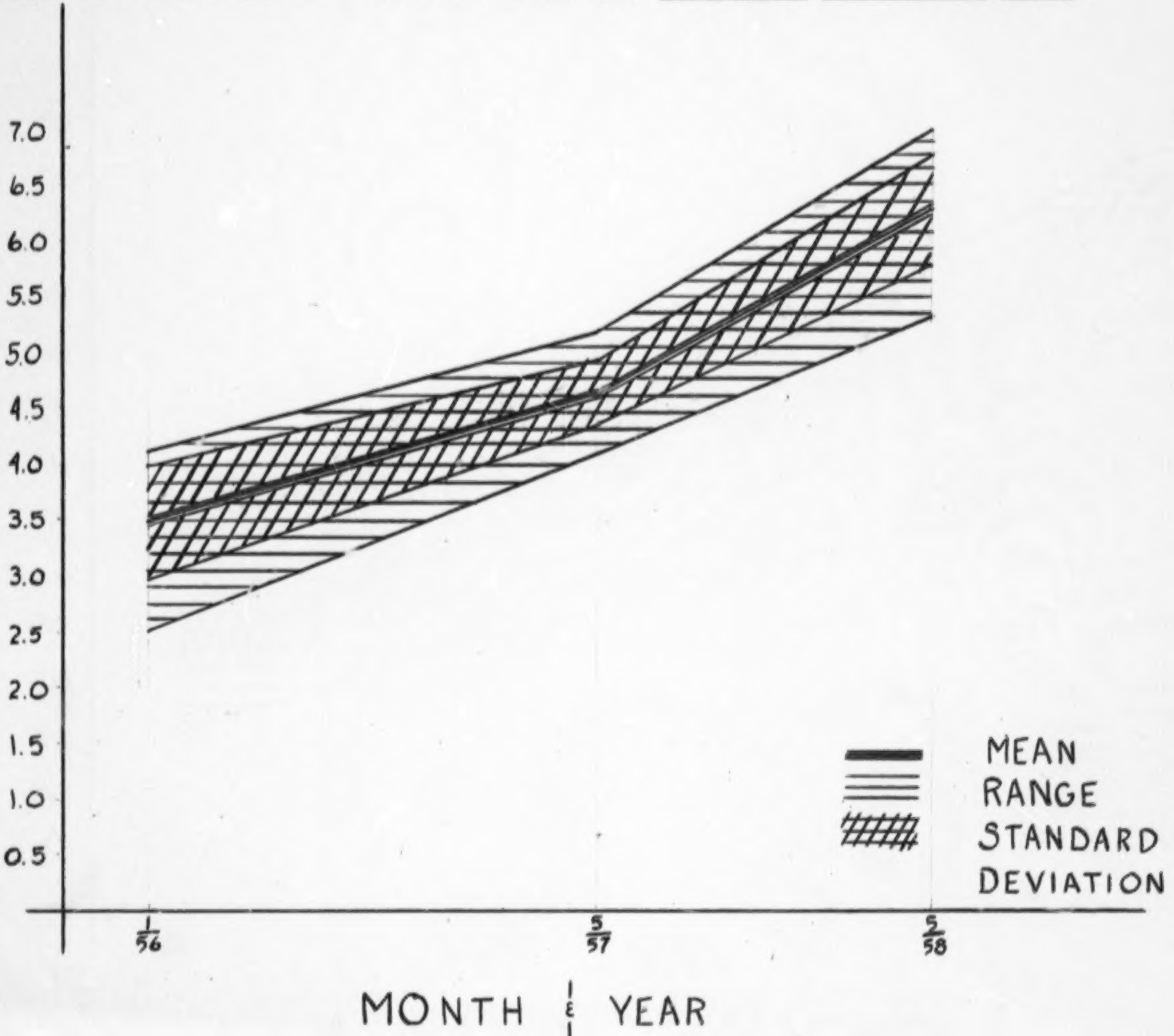
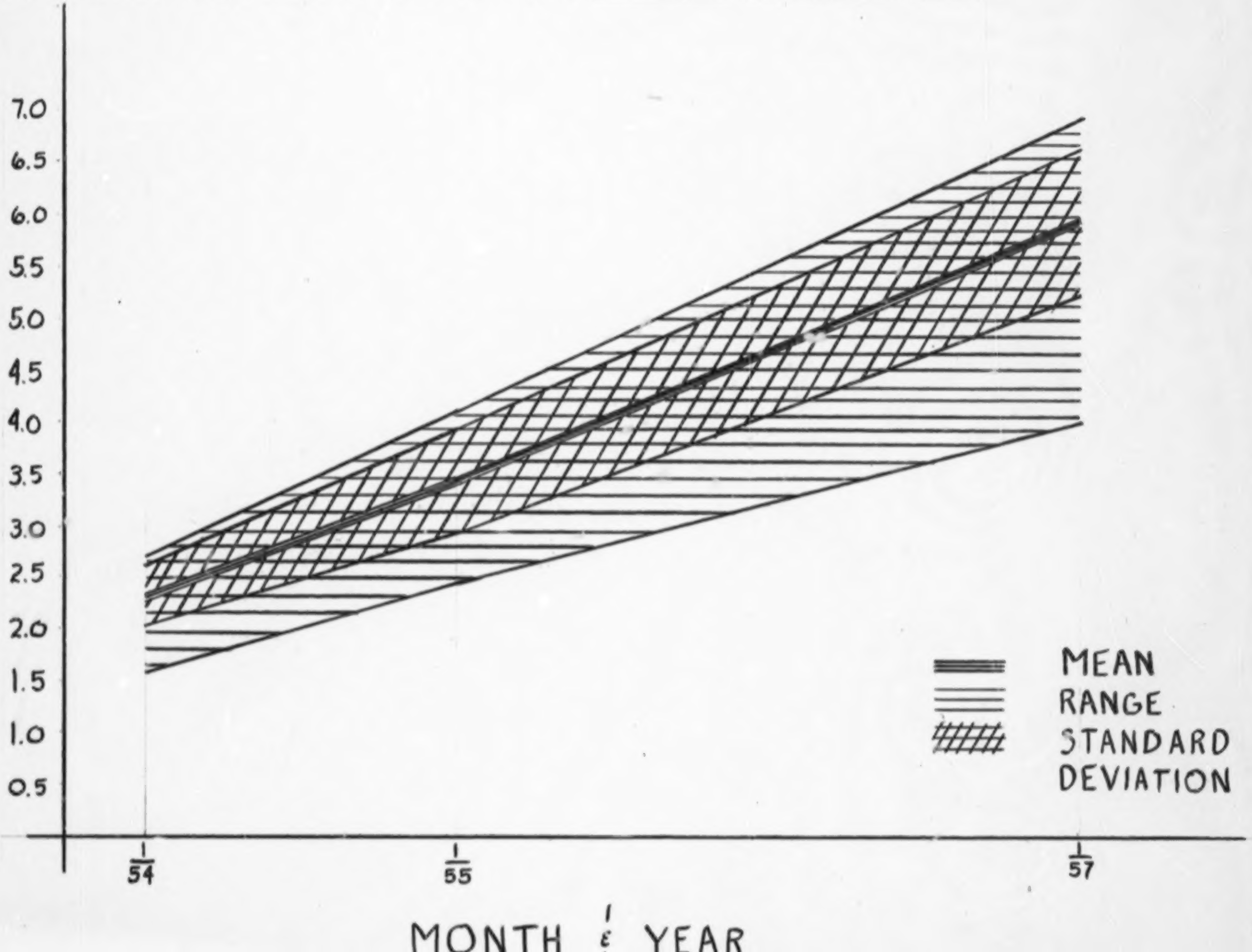


Figure 40

Longitudinal Representation of Composite Growth in Achievement for Grade Twelve in Terms of Mean, Standard Deviation and Range, California Achievement Tests



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